THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE ENGINEER IN THE MINE.

A VERY interesting position has arisen in South Africa regarding the status of the electrical engineer in the Rand gold mines. It is well known that the mining industry in that district has reached a very high state of efficiency, due largely to the intelligent use of the latest mechanical appliances and scientific processes. It is not easy to obtain a sufficiency of native labour, and, therefore, labour-saving devices receive careful attention, and—if successful—are often adopted on a large scale.

The mechanical engineer to the mine is, consequently, an important person, and in the past when electricity was only used for lighting and, perhaps, driving a few motors, the electrician was necessarily a subordinate. During the past few years the position has been considerably modified. Electrical energy at extra-high pressure is brought to the mine from an outside source; it is then transformed to a medium pressure, distributed to different parts of the mine, again transformed, and, finally, is made use of in nearly every process of the work.

The electrician has to be an engineer, with a correspondingly wider sphere of work. The mechanical engineer naturally enough strives to maintain his official superiority, while the electrical engineer refuses to accept responsibility.

The Transvaal Government has recognised the danger of such a state of affairs in the principal industry of the country, and has tried to heal the breach by issuing regulations insisting on mining machinery being under the direct responsible charge of properly certificated persons. These regulations provide for two classes of certificates, one for mechanical and the other for electrical engineers, and as some doubt arose as to their precise interpretation, a deputation from the South African Institute of Electrical Engineers recently waited upon the Government to discuss them.

The deputation consisted of Mr. J. H. Rider, the President of the Institute—well known in this country as the late tramways electrical engineer to the London County Council—Mr. Perrow, and Mr. Rowland, the secretary of the Institute; they were received by Mr. Kotzé, the acting Government Mining Inspector, and Mr. Vaughan, the Chief Inspector of Machinery.

As it is only a question of time and progress—largely the latter—before a somewhat similar state of affairs may arise in this country, it is interesting to note the questions put by the deputation, and the attitude taken up in reply.

The regulations insist that all machinery shall be in charge of a responsible certificated person, and the mine manager must appoint persons with the requisite qualifications. The first query was whether an electrical engineer, who after examination had had his certificate endorsed for mining machinery, would be eligible for taking full control of, and responsibility for, the mine machinery. The reply was

that if the endorsement extended to all classes of mining machinery, and was not restricted to merely *electrical* mining appliances, he would be. It was, however, open to the examiners granting the certificate to limit it in accordance with the results of the examination, while it was open to the electrical engineer to claim to be allowed to sit for the whole of the examination. In like manner the holder of a mechanical engineer's certificate could qualify for one as an electrical engineer. It was then made clear that without an endorsement regarding *electrical* mining machinery, no electrical engineer would be recognised for employment in a responsible position in a mine.

The next point referred to what might happen if two engineers were appointed, and here it was stated that both would have clearly marked duties, so that neither would interfere with the other or overlap as regards responsibility.

If the electrical engineer is responsible for the high-tension network, ought those who may be his official superiors to have the right to enter sub-stations where high-tension switchgear is placed, without his knowledge and presence? The deputation pointed out that in some cases the mechanical engineer or the mine manager, nominally in charge of the whole of the mine, kept the keys, and might even operate the switches, while the electrical engineer was legally responsible. It was pointed out how difficult it would be to debar these officials from examining any part of the machinery under their care, but that if experience showed it to be advisable, a stipulation that such officials must be accompanied by the electrical engineer would be added in a year's time.

One of the requirements for obtaining a certificate demanded that a candidate should have been "in charge" of plant of at least 250 H.P. for not less than three years. In a mine in which the mining engineer has in the past been rated as the higher official, would he *ex officio* be regarded as in charge, or would his subordinate electrical engineer, who had actually been responsible, be now eligible to apply for examination for his certificate? If not, would the mechanical engineer who was nominally in charge be allowed to count this as a qualification in applying for an extended certificate? It was agreed that the aim of the regulation was not to disqualify any competent worker, and that *ex officio* charge alone would not be recognised by the examiners. A further query related to a slight difference in the wording of the qualifications necessary for obtaining the two classes of certificates. In the case of mechanical engineers, apprenticeship or pupilage is demanded; in that of electrical engineers, the words "practical experience equivalent thereto" have been inserted. The fear was expressed that this might make it easier for a mechanical engineer to get an electrical, than for an electrical engineer to get a mechanical engineer's certificate. It was shown that this fear was groundless, as was also that with regard to the relative proportions of mechanical and electrical engineers upon the Board of Examiners.

It was felt on all sides that the points dealt with were only of a temporary nature, and that in a comparatively short time all mining engineers on the Rand would have both electrical and mechanical attainments, which hitherto had largely been held by distinct persons.

This will only be following what has been the trend in other directions; the specialised electrician in whatever groove—if the work on which he is engaged is important and successful—must either qualify as an all-round engineer for that particular branch of engineering, or allow the smarter engineers of the industry to oust him by themselves acquiring—in addition to their general information—the special knowledge which he possesses. Electrical knowledge forms an excellent entrance into many engineering fields, but it is only an entrance. An electrician or a purely electrical engineer has in the industrial world a certain not very high value; if he wishes to win his way to a high and thoroughly responsible position he must be ready to qualify in all the details of the department of engineering of which his specialised knowledge forms a part, and not be content with his electrical attainments.

Wanted: British Fairness in the Canadian Market.

On one or two occasions we have felt compelled to criticise those responsible for giving out public contracts for electrical and engineering work in some of our Colonies, for their lack of elementary fairness towards outside tenderers. We need not recall the details in these pages, but they are brought vividly before our minds once again by some comments appearing in the editorial notes of our contemporary the *Canadian Electrical News*, under the title "Bad Business Form." We have no information to tell us what particular contract is here referred to, nor do we know whether the successful tenderer was a Canadian or an English firm; but that can make no difference, for obviously there has been a transgression in breach of one of the commonest of business principles. Our contemporary occasionally hears complaints from manufacturers and others who deal in electrical apparatus "that they do not receive fair treatment when tendering for municipal or other work in Canada." We were under the impression that when we uttered a complaint on behalf of British tenderers regarding the same Dominion our contemporary failed to see the reason for our protest. That our information, on the whole, was not far from the truth is, however, borne out now by the rumours that reach the editor first-hand in Toronto. An aggrieved manufacturer has placed before him the circumstances of a recent experience in which, "following the submission of a tender for the supplies required, further and confidential information was asked *after the contracts were let*—this latter fact being kept secret from this particular tenderer." The firm happens to be located in the United States, but it solemnly asserts that after such treatment as this it will not again tender for Canadian business. No doubt there will be some who will feel satisfied with this result, whether they so express themselves or not; but our contemporary obviously regrets that "our municipalities and private companies in general thus lose the benefit of this healthy competition." The *Electrical News* goes on to add the opinion that such practices are not in accord with the most approved business methods of the present century, and, quite apart from the moral side of the question, they will "in many ways tend to retard the progress of electrical operations in our Dominion." "That these negotiations were in charge of a recognised electrical engineer intensifies rather than condones the objectionableness of such a course. Professional self-respect, we think, should be sufficiently strong to render any engineer superior to the pursuit of a line of action that smacks of sharp practice."

We are entirely at one with our contemporary in its criticism, and we hope that its protest will help toward ensuring a larger degree of fairness in the future.

Experience has shown beyond all dispute that British electrical manufacturers—excepting, perhaps, in one or two specialised cases—must be "right there" with technical and commercial representatives capable of submitting tenders speedily and in complete form, because the period for which contracts are open is short. But the suspicion that all is not fair and above board may form another argument, not so far previously employed, in favour of being on the spot: first, so as to keep on the track of a contract until it has passed through critical stages, and, secondly, in order to see that no information is divulged after the "other man" has secured a success. But it may have yet another effect by leading British firms to adopt the attitude of the U.S. firm

mentioned above, and leave the market severely alone! Our manufacturers can make the best of electrical and other machinery and goods suitable for Canadian service, at lower prices than obtain in a country where wages are so high. They are anxious to compete for the classes of business for which they are well fitted; they have shown in a number of cases that they can successfully do so. We have it, on the authority of our own special representative in Canada, that British manufactures can be obtained promptly, notwithstanding the thousands of miles of ocean to be traversed. Our promises, it is found, can be relied upon for specially-made lines, and for standard lines our firms could compete by keeping stocks there. British electrical manufacturers *want* to do a better business with Canada. The curve recently published in our "Canadian Notes," and the statistics which appear on another page of this issue, show just where we stand. We all recognise the vastness of the electrical opportunity that is coming, consequent upon present-day developments, but Britishers certainly will expect of their Canadian kith and kin that they will not play them false.

Conditions of Contract.

Our contemporary, the *Brisbane Courier*, waxes sarcastic about certain conditions of contract put forward by the Metropolitan Water and Sewerage Board, and deduces that the advisers of that Board have been influenced by reading "Alice in Wonderland."

The fact that the condition in question has appeared in connection with most of the public tenders in this country for many years, together with other conditions equally fantastic and iniquitous, does not seem to be known to our contemporary, which approaches the question with the open mind and fresh judgment which one would naturally expect in a new and breezy country. The authority in question in inviting offers for the construction of a dam, lays down the conditions, familiar, alas, to our readers, but apparently novel in Australia:—

> **If in the execution of the works it shall be found that anything has been omitted or misstated, either in the drawings or specification, which is necessary for the proper performance and completion of any part or parts of the works, the contractor shall, at his own expense, execute the same and provide whatever may be requisite for so doing.**

Our contemporary speaks of it as "an exquisite little bit of fun."

It does not mention whether the engineer to the authority is sole arbitrator as between itself and the wretched contractor; but if the conditions are, as we expect, modelled upon the highest English practice, we should think that important provision will not have been omitted. The *Brisbane Courier* remarks that "Any contractor who signs such a clause must do so with a firm reliance upon the good offices of some 'friends at court.'"

Therein doubtless lies the grand secret which keeps a select few of the contracting or constructive men, the "master builders" of the age, outside the Bankruptcy Court.

We are glad to reflect that the "Model Conditions of Contract" of the I.E.E. exclude these scandalously unfair conditions, and we hope to live to see the day when no Court of Law will enforce them. Even now there is hope, for the Courts have recently found that an "engineer" may not hinder a contractor from laying tram-rails and at the same time, as sole arbitrator, fine him for delay in carrying out the work.

Also it has been found that by going to law and calling the engineer as a witness, you can thereby deprive him of the privilege of being judge in his own cause.

We look forward to the time when municipal and consulting engineers will design and specify their works correctly, and consequently be able to dispense with conditions which throw all the responsibility for their own work, in addition to his proper duties, upon the unfortunate contractor. They will then have to be trained more as broad-minded and capable engineers, and less as narrow pettifogging lawyers. And, of course, they will have to be given remuneration which will render them independent of the inducements to be just, at which our contemporary hints.

The New Elevator Regulations in South Africa.

The New Mines and Works Act, 1911, introduced by the South African Government last year, contains regulations dealing with elevators, lifts or hoists, as they are variously termed, and the control of these now comes under the Mines Department. In South Africa, as well as in Australia, the Mines Department has two classes of Inspectors, one a mining engineer, and the other a mechanical and electrical engineer who is called an Inspector of Machinery. It is the latter who is to be responsible in future for the safe working of all elevators wherever they may be employed.

So far as the Regulations themselves are concerned, we do not think there is anything that is not already included in the specifications of first-class makers of hoists, and, as a matter of fact, they seem to apply more to the owners of elevators, to ensure that they shall be properly worked and cared for, and under the Act the Inspectors are given a good deal of power in this respect. Every elevator, for instance, is to be in charge of a competent person of not less than 16 years of age, with at least one month's training by another competent person; he must not leave his post unless relieved by another operator; and he must be removed by the owner if the Inspector deems him incompetent or disqualified to work the elevator.

Due notice must be given to the Inspector of all new elevators to be installed, old ones replaced, or repairs effected, and they are not to be put to work until they have been inspected and a certificate has been granted. This certificate is to be placed in a framed and glazed locked case fixed inside the elevator car, and must have on it the date of the inspection and the maximum number of persons allowed to ride on the car. The maker's name must also be fixed in the car, so as to be easily observable. A number of rules deal with the construction of hatchways, all guarding against the possibility of persons falling into them, the construction of gates, locking or fastening the same, efficiently substantial construction of overhead work, guide-rails, &c.

In the case of "push-button" elevators, it is, of course, not necessary for an operator to be in attendance, but the doors or gates at landings are to be so secured that no door or gate can be opened, or remain open, except when the car is at that landing; which is, of course, the usual method of construction.

The rules are very particular in regard to ropes, and each elevator must have at least two ropes, either independently connected or connected through a hinged bracket. The rules relating to the ropes and inspection, which appear elsewhere in this issue, will, we think, be of interest.

With regard to speed, the maximum is 400 ft. per minute, except in the case of an elevator which runs 80 ft. or more without a stop, which may run up to 600 ft. per minute. A clear space of 3 ft. must be left between the bottom of the hatchway and the underside of the car when it is at the bottom landing, and "there shall be placed substantial buffer springs." The same distance must be allowed at the top, which is increased to 5 ft. when the car runs at a speed of 350 ft. per minute.

Safety devices in the shape of speed control, safety catches for catching and holding the car—these to be capable of holding the car and twice its maximum load—and automatic stops, which must stop the car either at the top or the bottom before it has passed the landing by a distance of 2 ft., must all be provided.

The same regulations practically apply to goods elevators, with the addition that, if fitted with rails on the floor, these must be countersunk, and they must be provided with gates, bars or doors to prevent goods rolling out.

The Rating of Tramways.

It is not often that a decision which has remained unquestioned for nearly 20 years is overruled by the Court of Appeal. Such, however, has been the fate of Swansea Improvements and Tramway Co. *v.* Swansea Urban Sanitary Authority (1892), Q.B. 357, where it was laid down that the land occupied by a tramway was not "used only as a railway"

within the meaning of the Public Health Act, and that the appellants were *not* entitled to be rated in respect of it in the proportion of one-fourth part only of its net annual value. As many of our readers are aware, land used as a railway is relieved of rates by being charged thereto at only one quarter of its rateable value. In 1892 tramways were held not to be entitled to the same privilege on the ground that tramways were something essentially different from railways, and that the Legislature could not have intended to include both under the term railway.

This decision, however, has been much blown upon in recent years, and is now finally overruled by a case reported in our "Legal" columns this week—namely, Metropolitan Electric Tramways, Ltd., *v.* Tottenham U.D.C. It appeared that the tramway property of the company in Tottenham was rated at £4,575, upon which a rate of £496 was demanded. The company refused to pay more than a quarter of this sum, and the case eventually reached the Court of Appeal. It transpired that certain light railways of the company in the same district were rated at the lower figure, as it was admitted that they were "railways" in the sense of the Act of 1875. In arriving at the conclusion expressed in the judgment of the Court, Lord Justice Farwell adopted the view of Sir Gorell Barnes upon the question whether a tramway is a railway:—"Physically it seems to me that it is a railway; it is a road containing rails on which vehicles must travel in the ordinary way in which railway traffic is conducted." Those observations applied to the facts of the present case. Further on he said, "I have difficulty in appreciating exactly what is meant by putting in the words 'constructed as a railway.' If it means constructed as a railway in fact, it seems to me that their own statement in argument shows that this case comes within that definition. If it is meant to say that it must be constructed as a railway to which all the railway legislation applies, I do not find those words there, and it does not seem to me that it is necessary to put such a construction upon the Act."

This decision appears to us to be consonant with justice and common sense. The general scheme of a well-developed rating system should be to make the occupiers of property most benefited by the expenditure of the district rates liable to be rated at the higher rate, while the occupiers of classes of property less benefited should be rated at the lower rate. The decision, too, is of enormous importance to companies like that which was courageous enough to prosecute the appeal.

The I.E.E. We are glad to announce elsewhere in this issue that the Institution of Electrical Engineers will this year hold a summer meeting; this is one of the items of the programme of progress which has been before the Council for some time past, and will be welcomed as a foretaste of the benefits to follow. It is true that the Institution has on several previous occasions organised summer excursions, but these, with one exception, have taken the form of tours abroad, and all have involved an expenditure which has necessarily limited the numbers of the party to a very small percentage of the membership. Moreover, each tour has been special in itself, and the practice has not been regarded as a normal feature of the year's doings.

Now, however, we take it that the holding of a summer meeting is to become a matter of routine, and we hope that the experience gained this year will prove that the opportunity of passing a few days together for profit and pleasure is heartily welcomed by the members, and that a very large attendance will be recorded. The great popularity of the Institution's annual dinner, which this year especially was so admirably planned and conducted, is no doubt largely due to the feature by which it is distinguished from other functions of a like nature—the provision for a social reunion—and this augurs well for the success of the summer meeting.

Beyond the fact that it will take place at Glasgow, in the middle of June, no details have been announced—we do not know, indeed, that a programme has yet been formulated. However, there is no lack of interesting material for visits in the neighbourhood, and we do not suppose there will be a shortage of papers for discussion.

ELECTRICAL LAW IN THE BRITISH DOMINIONS.

[FROM OUR LEGAL CONTRIBUTOR.]

The above subject is of increasing importance to English manufacturers of electrical machinery, in view of the largeness of their volume of exports to the markets of the Dominions.

Although questions relating to the legal authority under which electricity may be supplied are of local rather than of Imperial interest, it may be sometimes important for those who are connected with electrical manufacturing to be informed as to how far, and by what authority, electricity may be supplied in various parts of the Empire. Such information, especially with regard to our more distant and less well-known Dependencies, is not easily obtained. No doubt copies of every ordinance and Act may be seen and studied at the Colonial Office; but those august precincts are not within the reach of all. Further, in order to find all the legislation concerning electricity in any particular colony, it is necessary to wade through all the statutes and ordinances for the colony; for it often happens that earlier measures are much modified by later legislation, and in many cases the labour of the student is not saved by reliable indices.

In these circumstances a synopsis of electrical legislation in the more important colonies of the Empire may be found useful to readers of the Electrical Review. It does not purport to be an exhaustive treatment of all the material statutes and ordinances relating to electricity ever passed in every dependency. Thus it makes but casual reference to the various measures which have been rendered necessary for the purpose of introducing the use of electrical power on tramways, and it does not deal in any way with telegraphic or telephonic legislation. It is hoped, however, that the summary will be found useful to any person who desires to know something of the law relating to electric light and power in all the more important colonies.

It is proposed to deal with the various Dominions in the following order:—

1, New South Wales; 2, Queensland; 3, Victoria; 4, South Australia; 5, Western Australia; 6, British Columbia; 7, British Guiana; 8, Canada; 9, New Brunswick; 10, Ontario; 11, Quebec; 12, Nova Scotia; 13, Cape Colony; 14, Ceylon; 15, Jamaica; 16, Orange River Colony; 17, Natal; 18, New Zealand; 19, Southern Rhodesia; 20, Tasmania; 21, Trinidad and Tobago.

1. *New South Wales.*—There does not seem to be any general legislation relating to the supply of electricity on the statue book of New South Wales. The treatment which is likely to be accorded to electrical undertakers whether private or municipal, may, however, be gathered from the Municipal Council of Sydney Electric Lighting Act, No. 23, of 1896. That Act is entitled "an Act to enable the Municipal Council of Sydney to light the streets, also private and public places of the City of Sydney with the electric light, and also places outside the said city, and to exercise all powers necessary for such purposes, and for the above purposes to raise by debentures the sum of £250,000." Sec. 3 of the Act provides that "it shall be lawful for the Council to generate and supply electricity for any public or private purposes, or for any public purposes, and any private purposes within the limits of the City of Sydney. Provided that electricity may be supplied outside the said limits in manner hereinafter set forth." Secs. 14-18 confer upon the Council the right to break up streets, &c., for the purpose of laying their installation. In the course of this work they are bound to give all the notices, &c., which are rendered obligatory upon undertakers who supply electricity under provisional order in this country. Sec. 19 contains a provision to the effect that in the exercise of their powers the Council must do as little damage as possible, and must pay compensation for all damage. A similar clause appears in provisional orders in England; but the statute under notice contains the following proviso:—"Provided that the Council may in all cases be at liberty to set up by way of defence or in mitigation of damages, as the case may be, that the person claiming compensation has by his own act,

neglect or default caused or contributed to the damages in respect of which he claims to be compensated." The provisions of this Act which render it obligatory upon the Council to furnish a supply "without fear or favour," follow closely upon the lines of our Electric Lighting Acts.

(To be continued.)

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

MANITOBA is about to appoint a "Public Service Commission" for the Province, which is to look after steam and electric railways, gas and electric lighting, telegraphs, telephones and other "public utilities" as they are called in this country.

A proposal is on foot to make a canal commencing at Lake St. Francis, at a point about 40 miles south-west of Montreal, which would divert practically the whole of the St. Lawrence River at that point, and run it into the Ottawa River, close to Isle Perrot. This canal would be about 12 miles long, and there would be one lock for navigation purposes. The total fall would be about 85 ft., and the theoretical power available would be something like 960,000 H.P.

So far as electrical engineers and manufacturers are concerned, it may be said that in this country there seems to be, at the present time, a general awakening to the fact that electrical work here is not at its best, and that much of the apparatus and many of the methods employed are neither so satisfactory nor so safe as they might be.

The proposed formation of "Commissions" in various parts of the country to control electrical work is an evidence of this recognition, and that the next few years will see a great improvement in the standard of work cannot be doubted.

The present rules governing practically all installation work in Canada are those of the Canadian Fire Underwriters' Association, a body which itself has borrowed these rules from a similar association in the United States. Now, while it is true that these same rules are approved by the American Institute of Electrical Engineers and others, a careful perusal of them already shows that only materials, fittings, &c., which are standard in America are taken into serious consideration, and, besides this, a separate pamphlet is published of "approved" apparatus and fittings made by various firms—every one of these firms being American.

As an instance, it may be stated that metal conduit is required to have a minimum wall thickness equal to that of gas and water pipes, whereas the Engineering Standards Committee in England, even for the "heavy" class of conduit, require a wall which is much thinner than this.

Fire insurance companies are, naturally, not especially interested in furthering the interest of the electrical industry, and therefore they only consider in their rules such materials and methods as are to hand. Again, the average contractor does not go out of his way to find materials or to adopt methods which, if he went to the trouble of inquiring, *might* (or might not) receive the approval of the fire underwriters. He also takes what is ready to his hand, and the importers of electrical apparatus, seeing the rules, do not risk losing over a lot of material which, for all they know, might not be allowed.

There is a probability, however, that before long other rules may be published by some recognised public body on lines to which the fire insurance companies can hardly take exception, which will give electrical manufacturers wider opportunities, and it will be then that the British manufacturers should be able to step in with ready-made material and apparatus which can comply with such rules, as there is a growing tendency to favour European practice in many respects.

The writer of these notes is trying to arouse public opinion, though the technical Press, on the desirability of an Engineering Standards Committee being formed in Canada on the lines of the British one, so that definite standards, international in character wherever possible, may be adopted, as in a few years the present system of framing and adopting standards in this country will tend to serious confusion.

Further than this, American imports of engineering materials and apparatus to Canada preponderate so largely over British that, if this state of things continues for several years longer, almost everything will become automatically standardised on American lines, to the great disadvantage of the British manufacturer.

The question of putting all overhead wires underground in the busy parts of the larger towns and cities here, which has already been referred to in these notes, is being dealt with in a more businesslike way than hitherto.

The Dominion Government is considering the question, and in Ontario several of the more important places such as Toronto, Hamilton, &c., are seeking powers from the Legislature to enable them to compel all electric light, telegraph and telephone companies to put their wires underground. The method proposed is that the municipalities should build the conduit subways and that the various companies should pay a rental for such portions as they need.

In regard to water-powers, a new phase seems to be developing itself here. Formerly, the making of canals was one thing and the utilisation of the water-power thereby secured was another and secondary consideration. Now, however, it is probable that the two items will be looked at in their relation to each other, and a canal will be built on such lines as will provide the maximum amount of water-power possible under any given circumstances. The sale of such water-power will, in many cases, go towards repaying the cost of making the canal. Undoubtedly it is high-tension transmission at potentials in the region of 100,000 volts which renders such an idea possible, as only by this means could a large amount of power, itself located, perhaps, in a sparsely-populated district, be utilised.

NOTES ON RENEWING TUBES IN BABCOCK & WILCOX BOILERS.

BY WALTER E. ROGERS, A.M.I.E.E.

So universal and world-wide has become the adoption and use of the Babcock water-tube boiler, that it is no unusual thing for us of the electrical profession to find ourselves, in some outlandish quarter of the world, suddenly called upon to take charge of, or supervise, the repairs to a battery of the above type of steam generators.

Assuming that the necessary tools and materials are available, and that a tube in the lower row of a nest has blistered and punctured, proceed as follows:—From inside the furnace chamber, with the aid of a chain-wheel tube cutter, cut the faulty tube immediately below the blister, *i.e.*, at the side of the blister remote from the boiler front. Repeat the cutting operation as close up to the front of the boiler as is possible: we thus have the portion of the tube containing the blister completely free for removal through the furnace door. The remaining portion of the tube should then be cut each side of the flame bridges or compartments. Finally, the header caps, back and front opposite the particular tube concerned, having been removed, the ends of the tube should be split with a hammer and chisel, care being taken not to damage the seatings in the headers whilst carrying out the splitting process. Usually, after two slits have been made in the ends of the tube, approximately 2 in. apart, it is an easy matter, with a bar some 2 ft. long, to depress or bend in the ends of the split tube, using the front or edge of the header as the fulcrum point for the bar above mentioned. The point where a tube generally blisters or fails, is approximately 1 ft. 6in. to 2 ft. in front of the flame bridge.

After having examined the header seatings to see that they are undamaged and clean, ready for a new tube to be expanded, the new tube may be inserted through the front header. Care must now be taken, before commencing to expand the tube on to the seating in the header, to see that the ends of the tube project at least ½ in. through the seats,

to allow for bellmouthing over after the tube has been well expanded. Also, the tube should be securely chocked or scotched between its end and the inner side of the headers facing a cap joint; this prevents the tube being driven too far through the seating when the mandrel is driven into the expanding tool. Incidentally, when withdrawing an old or inserting a new tube, care must be exercised not to damage the flame bridges.

So far I have described what is quite a simple proceeding, involving no great difficulty. Unfortunately, it is not always a tube in the accessible lower row which it is necessary to renew. Should a tube in the second row be at fault, I consider it prudent on economical grounds to scrap the one below as well; we thus have two tubes to renew, but the additional cost of the extra tube will generally be less than that disclosed by an examination of the time sheets after a second row tube has been renewed without scrapping its lower neighbour. Of course, I am only here referring to bad cases, where the tubes are badly hogged, blistered or "skellerd," as a Yorkshireman would say. Assuming, however, that we intend to remove the faulty tube without interfering with others, commence by splitting both ends of the faulty tube, as already described, then from the rear end punch the tube forward until the tube projects sufficiently far through the front header to enable it to be turned round by means of pipe tongs, or a bar punched right through the projecting end. Thus, the tube can be held in such a position that men in the furnace chamber, with a long punch and a striking hammer, can so reduce the dimensions of the blister, that the tube will pass completely through the front seating orifice on its way to the scrap heap. Incidentally, the aforesaid bar punched through the end of the tube serves as a useful means for attaching a set of chain blocks to assist the removal, and punching from the rear greatly facilitates this.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Economy of Electric Cooking.

May I trespass on your space to reply to "F. R. C.," who thinks I am an enthusiast and too optimistic about the future of electric heating?

I am quite ready to agree that it does seem as if electric heating of rooms is an expensive luxury; but gas fires are much more expensive than coal, yet they are largely used by the middle classes in spite of that and for obvious reasons. These same reasons apply, but with more force to electric heating.

This middle class used not so long ago to be satisfied with a house without a bathroom and with outside closets of an unhealthy type, but in spite of the higher cost they now demand porcelain enamelled baths, porcelain hand basins in the bedrooms and perfect sanitary arrangements indoors. For the same reasons electric heating will certainly supersede gas heating. Further, the apparent high cost of the hygienic improvements is more than counterbalanced in saving of life and doctors' bills. For these reasons, and others as weighty, I am optimistic.

My chief point was, however, that if electric cooking is adopted the kitchener or a gas water heater is neither necessary nor desirable. In spite of "F. R. C.'s" affection for the gas, I know in my own circle of two catastrophes nearly ending fatally due to a gas geyser, and I do not think I am either unique or particularly unfortunate as to my friends. I willingly credit gas with the ability to heat water, but I can also honestly credit it with enormous damage to life and property. I also demand that the devil shall have his due, but I fear that if this particular one gets his, he will have a bad time of it.

Destructive criticism is, however, easy, and I should like again to give figures which should dispel any feelings that electricity is incompetent to heat water with reasonable economy. The average amount of water used per person per day in London is 30 gallons, so that a household of five persons may reasonably be assumed to require 150 gallons per day. I assume that half of this at 110° will meet the requirements for hot water, which I think is reasonable—perhaps liberal.

The electric light account for such a household might be about £6 at 4d. per unit, or 360 units per annum, equivalent to 42 watts taken day and night all the year round.

To produce the required amount of hot water will require about 600 watts, so that the requirements of the house will be met with a continuous supply of about 640 watts, which at 6d. per watt per annum would cost £16, or £10 for hot water supply.

This supply could be laid on to every room and any sized tap desired by "F. R. C." There would be hot water any time of the day or night, and not so very much dearer than the kitchener, taking it all round.

If any of my figures are unfair, the calculation can be used for the new ones.

I shall be happy to supply heaters for such a quantity of hot water at less than the £5; most makers will quote a lot less.

Percy Good.

London, S.E., *February 10th*, 1912.

In reply to Mr. Silver's letter, I really must deny being pessimistic or indulging in a "can't-be-done" attitude. But I do not believe that this attitude is the cause of "the unsatisfactory state of the electrical industry." (The expression is Mr. Silver's.) It would be better for the electrical industry if the young optimists of the advertising and sales departments paid more attention to detail, and made fewer preposterous claims for their wares. These glib enthusiasts (there were hundreds at the exhibition) have created a vast army of disappointed and disgusted consumers, who, of course, spread the mischief by warning all their friends.

I agree with Mr. Silver that electricity should be used where commercially possible, and this is my precept and practice. My letter was merely to point out that, at a penny a unit, electricity was out of the running for house-warming and for the domestic hot-water supply. *Evidence* to the contrary will be very useful to many of us. I have in mind two or three consumers who tried electric house-warming. It would be very difficult now to persuade those victims of good salesmanship that electric cooking is successful from every point of view and a boon and a blessing to women. I am glad that I do not know anyone who has ever tried electric water-heating. By the ordinary formula, it takes about 0·25 unit to raise a gallon of water from 60° to 140° F. My gas heater does it for 1·3 cb. ft., *i.e.*, 0·045d. and supplies the taps in bedroom, bathroom and scullery.

Mr. Silver's last paragraph cannot be over-emphasised. It is business ability that is required—not the smart, insolent irresponsibility that now passes for it in so many instances.

F. R. C.

Arc Lamp (Span Wire) Lowering Gear.

We noted with some surprise your correspondent's letter on the above subject in your issue of January 26th. Surely it would have been wiser if "N. D. W.," before assuming the *rôle* of critic, had put himself into communication with us and sought enlightenment on the points he so superficially criticises and condemns, instead of rushing into print and misleading your readers. Fortunately for us, the class of men who are immediately interested are too cautious and well informed to accept so hasty a condemnation from an anonymous pen in a matter of this nature, and can judge for themselves from your very concise and general descriptive article on our appliances. We do not wish to encroach unduly on your courtesy by entering into a comparative controversy, and would ask those interested to reserve judgment and put themselves into communication with us for further particulars. We do not despair, if your correspondent is a *bona fide* "anxious inquirer," of counting him among our converts. Surely we are not so utterly stupid as to risk our business reputation by putting on the market so crude an appliance as your correspondent "N. D. W."

conjures up as a basis for his criticism. A little foresight, invention, and careful attention to details, can get over many of the imaginary difficulties "N. D. W." foresees. We assure him we have solved the difficulties referred to, and our gears, by a simple arrangement, will operate satisfactorily in a gale of wind and rain if need be, without skill in operation. He confuses two separate arrangements, and tries to deal with both at once. Surely it is better in busy streets like those of London to bring the lamp, securely suspended, to the side for lowering, and out of the way of the traffic, and not to endanger the lives of the passers-by by starting to lower in the centre.

The cable is permanently fixed at the centre, and the alignment of the contacts is absolutely assured in the set first illustrated. In No. 2, the trouble "N. D. W." foresees is forestalled and overcome, and the arrangement has much to recommend it for simplicity, efficiency, and cheapness. "N. D. W." must know, as a rule, that you cannot get two distinct movements combined in one without sacrificing some essential advantage.

The North-Western Electrical Appliance Co.

Darlington.

Kingston Diesel Engines.

With reference to my report of the above in your recent issue, and Mr. Edgcome's notes referring thereto, I enclose folio 15 of Mr. Edgcome's report for your inspection (and kind return), from which you will see that the British Westinghouse Co. were *not* invited to tender, but asked to be allowed to tender. A quotation from the folio would, perhaps, be the best evidence—if you could afford the space.

As regards the voting, a reference to my notes gives :—For the amendment 8, against 19, with 5 neutral ; for the recommendation 19, against 9, with 4 neutral. This was announced by the town clerk on a show of hands, but when Councillor Macaulay moved that the "names be taken," and this was agreed to, some of the 9 had not the courage of their convictions to be shown in print, and remained "neutral."

On the first show of hands, therefore, which was the "legal" voting on the matter, your news correspondent was right.

Your Correspondent.

Extract from report : "Messrs. the British Westinghouse Co. wrote me in December asking to be allowed to tender for combined sets of Diesel engines and alternators of their manufacture. They had not previously been asked to tender, as I was not aware that the firm were manufacturers of this type of engine."

[It will be seen that our correspondent was literally accurate in his facts, while Mr. Edgcome's claim that the British Westinghouse Co.'s tender received fair treatment is clearly substantiated by the article on page 169 of our issue of February 2nd.—Eds. E.R.]

The Electrical Profession as It Is.

I read with great interest the letter in your issue of February 2nd, signed by "Diogenes," and the somewhat scathing reply made by Mr. W. Ellerd-Styles, and should be glad if you could spare me some of your valuable space in which to express my humble opinion on the subject under discussion. Speaking as one who has been through the mill, I agree with "Diogenes" with regard to his remarks about the top dogs in municipal concerns, but how about the men in the smaller positions, the men who have all the responsibilities and have to do the brain work ? Surely, these must be the right men in the right place, otherwise what would become of the municipal concerns ? But perhaps "Diogenes" means that these men ought to be in receipt of the big salaries ? Probably they should, but they haven't all got a father-in-law or uncle, or other relation who can simply place them in the position, and, provided they hold their tongues, let them stop there. But "Diogenes," don't run away with the idea that the electrical profession is the only one in which big positions are obtained through influence, it is unfortunately the way of the world. With reference to the Institutions, I must agree with Mr. Ellerd-Styles that these are quite open to a really responsible man ; of course, there must be restrictions, but these in no way get in the path of the genuine electrical engineer. I can also agree with Mr. Ellerd-Styles on his remarks about the technical institutions ; I have been through their courses and seen and heard the actual things that he describes, but it is the last few lines of his letter that I should be glad heartily to support. The question is, How is it going to be done ? I am afraid we should find several so-called Electrical Engineers (big letters please) in a very bad plight.

Inquirer.

Our Progressing Manufacturing Firms.

In May, 1911, one of the largest electrical supply firms in the kingdom supplied over 100 street lighting fittings complete with globes. At the beginning of November last an order was given for spare globes for these fittings. Totally different globes were sent. The would-be customer then wrote asking that they should send a man from the local office to see the globes required. A representative duly arrived from the local office and took particulars of the globes. As the second lot of globes were also wrong, the unfortunate would-be customer again asked the representative to call. The representative called again, and took drawings and dimensions of globes. Then the would-be-customer gave an order for two fittings complete, with similar globes. The fittings duly arrived complete with the two right globes, together with a third lot of spare globes—all wrong ! The order was then cancelled, but on the local representative stating that correct spare globes were sent off, the poor customer waited until February 9th, 1912, only to receive a fourth lot nothing like those ordered.

The order given on November 7th was, therefore, cancelled on February 9th, for the second and last time ! Is it not wonderful ?

N. D. G.

The Telephone Service.

With reference to your remarks on the telephone service, it is curious to note that, from the beginning of this year, the service on the village exchanges round here, which has always been run by the Post Office, has all gone to pieces. The instruments are always out of order, and no trunk connections can be got. To-day a man came to attend to an instrument that had gone wrong, and after pulling it all to pieces, he announced that it was connected up wrong, although it had worked all right all last year !

The wiring is often done in a very slovenly and incompetent manner. Four people here have applied for the "Farmer's telephone" as promised by Mr. Buxton when Postmaster-General, but beyond an intimation that "the matter was under consideration," the Post Office has refused to give any information about it. I understand that this system is in use in some parts of the country, but do not see why the Post Office should refuse to give information, unless, as is freely stated here, the political views of applicants have something to do with it.

The Post Office should never have been allowed to touch the telephones. If the Government get hold of the railways too, goodness knows what will happen.

R. B. Verney.

Warwick, *February 12th*, 1912.

Social Event.—The 10th annual tramway employés' social was held at Darwen on February 9th. Alderman James Tomlinson, who presided, spoke of the good feeling existing between the Corporation and its employés, and mentioned that last year the cars carried 2,388,408 passengers, and only a sum of £3 was spent in compensation ; this showed how well the cars were controlled. Last year the receipts were £200 more than during the preceding year.

Radium in Austria.—It is announced that the Austrian Government will shortly purchase the pitchblende mines of Joachimstal at a cost of about £100,000, from which an output of 5 grammes of radium per annum is expected.

SOUTH AFRICAN REGULATIONS RESPECTING ELEVATORS.

The following are included in the new Regulations of the South African Government referred to in our leaderette pages to-day :—

252. (1) No rope shall be used for supporting an elevator car or counter-weight unless it is of good quality and manufacture, and free from any defect and of adequate strength.

(2) Every such rope shall be made of wire, and the gauge of the wires used in the construction thereof shall be suited to the diameter of the sheaves and drums fitted.

(3) No rope shall be used for supporting an elevator car or counter-weight when the breaking load at any point therein has become reduced to less than five times the maximum working load, the supporting effect of the other rope, if any, being ignored; provided always that in the case of elevators in which the cars or counter-weights are suspended by more than two ropes fitted with appliances for equally distributing the load a minimum factor of safety of ten will be allowed on the aggregate strength of all the ropes, but no rope shall have a lower factor of safety than three with respect to the maximum working load.

(4) The following particulars of ropes used in operating an elevator shall be recorded in a book termed the "Elevator Record Book" :

(*a*) Maker's data of rope when new, or a copy thereof, certified to by the user :—Name and address of manufacturer ; date of manufacture ; date of purchase ; length of rope in feet ; diameter of rope in inches ; weight per foot in pounds.

Construction of Rope :—Number of strands ; class of core.

Construction of Strands : Number of wires ; diameter of wires (decimals of an inch) ; class of core ; material of which wire is made ; breaking stress of material (tons of 2,000 lb. per sq. in.) ; breaking load of rope (tons of 2,000 lb.)

(*b*) History of Rope in Use :—Date on which rope was put on ; dates of re-capping, shortening, or turning end for end ; date on which rope was taken off.

253. Before renewing ropes on any elevator, full particulars of the construction, &c., of the new ropes shall be supplied to the Inspector of Mines.

254. (1) A responsible person, or more than one, specially deputed by the user for the purpose, and whose name or names must be registered by him in the elevator record book, shall carefully examine :—

(*a*) At least once each day the engine or motor, all drums and sheaves and all safety appliances.

(*b*) At least twice in each week the guides and ropes.

(*c*) At least once in each month the entire elevator plant and all fittings and appliances in connection therewith.

(2) At this monthly examination the rope, or ropes, supporting the elevator car and counter-weight shall be thoroughly cleaned for the purpose of discovering the amount of deterioration therein, and the strength remaining in each rope shall be assessed.

(3) This monthly examination shall not be carried out by any person other than a qualified mechanic approved by the Inspector of Machinery.

(4) A true report of the result of every examination above mentioned shall be recorded without delay in the elevator record book, which must be kept on the premises, and shall be signed by the person who made the inspection. This register shall be at all times open for the inspection of the Inspector of Mines or his representative. Should, as the result of such examination, any weakness or defect be discovered by which life or limb may be endangered, the defect shall be immediately reported to the user, and no person shall be raised or lowered until the defect is made good.

(5) All bar and chain connections shall, when practicable, be annealed at least once in every 12 months.

LEGAL.

Tramcar Accident : Claim against L.C.C.

On the 8th inst., in the King's Bench Division, Mr. Justice Avory gave judgment in an action in which a common jury awarded Mrs. Walsh £250, and her children £250, as compensation for the loss of Mr. Walsh, the husband and father, who was killed, it was alleged, through a London County Council tramcar colliding with the dray he was driving at Grove Road, Mile End Road. Mrs. Walsh and her three children sued the Council for damages for the death of her husband, due, she alleged, to the negligent driving of a tramcar in August last. Mr. Walsh was driving a dray, with three horses, towards his master's stables in Rotherhithe, when, in going under the railway bridge in Grove Road, a car ran into the dray and caused him to fall from his seat, with the result that one of the wheels of his dray passed over him and killed him. Defendants denied negligence and pleaded contributory negligence on the part of the dead man.

His Lordship entered judgment for plaintiff for £500, and costs.

Mr. Walsh applied for leave to appeal on the ground of misdirection of the jury by his Lordship on the point of the dray continuing on the metals after warning.

His Lordship did not think there had been any misdirection of the jury, and as the case appeared clear, he was not going to encourage the Council in spending the ratepayers' money in appeals when the grounds were so flimsy.

Tramway or Railway?—Important Rating Appeal.

The question of whether an electric tramway should be treated as a railway for the purposes of rating, was raised in the case of the Metropolitan Electric Tramways, Ltd., *v.* The Tottenham Urban District Council, which last week came before the Court of Appeal, composed of Lords Justices Farwell and Kennedy, and Mr. Justice Warrington. Under Sec. 211 of the Public Health Act, 1875, a railway is assessable to the local rates at not more than one-fourth part of the net annual value. In the present case the plaintiffs were the owners of both a tramway and a light railway within the defendants' district. As to the mode of construction and the materials used therein, they were identical, while the carriages used upon them were the same, and they were worked as one connected system. The electrical energy for working the tramway and the light railway was generated at the same power station. The plaintiffs, in respect of the light railway, were rated in the proportion of one-fourth part only of the net annual value thereof, but in respect of the tramway they were rated at the full amount, making a difference in the annual rate on the tramways of £371 14s. 4d. A Divisional Court composed of the Lord Chief Justice and Justices Darling and Bankes, held that they were bound by a decision of the Divisional Court in 1892 in the case of the Swansea Improvements and Tramway Co. *v.* Swansea Urban Sanitary Authority, and that the tramway as such did not come within the exemption under the Public Health Act. From this ruling the tramway company now appealed.

Mr. Danckwerts, K.C., for the appellants, said that since the decision in 1892 a great deal of water had flowed under London Bridge, and he submitted that that decision was inconsistent with recent judgments given in the House of Lords, bringing light railways within the exemption.

Lord Justice Farwell : If this tramway is really a railway within the meaning of the Statute you are entitled to the relief you ask, and you press us to say it is a railway ?

Mr. Danckwerts : Yes, a species of railway which under recent decisions must be treated as a railway for the purposes of local taxation. Counsel pointed out that though tramways and light railways were constructed under different Acts of Parliament they were, at all events in this instance, identical so far as form of constructing and running arrangments were concerned. In support of this statement he handed up to the Bench photographs of the tramway and light railway in question, and invited their Lordships to say which was which.

Lord Justice Kennedy observed that the photographs before him were marked, but he agreed that without some such indication it would be difficult to tell the difference.

Mr. Hutchinson, K.C., following on the same side, also submitted that, for the purpose of rating, tramways came within the decision which declared light railways to be within the exemption under the Statute.

Mr. Macmorran, K.C., for the respondents, argued that the decision of the Court below, supported as it was by authority, was right and ought to be affirmed. A tramway, he said, was constructed as a tramway and not as a light railway, and that was the test. Because the House of Lords had laid it down that a light railway was a railway for the purposes of rating, it did not follow that a tramway was a railway for the same purposes. It would be quite impossible to argue that a light railway was not a light railway ; therefore why should it be said that a tramway was not a tramway ?

Mr. Ryde, K.C., also for the respondents, thought their Lordships should hesitate before giving a decision which would involve considerable loss to local rates.

Lord Justice Farwell remarked that he had been hesitating all the morning. Was not that long enough ?

Mr. Ryde said that many local authorities in the belief that, under existing decisions, they would receive from tramway companies, as compensation for the disturbance of their streets, the full rates, had refrained from opposing tramway schemes in the past. If local authorities were now to be told that they were to receive one-quarter only of the rates, tramway companies would be placed in the position of having been granted concessions which they would not otherwise have obtained.

Lord Justice Farwell : You must remember that many local authorities are tramway owners.

Without calling upon Mr. Danckwerts in reply, Lord Justice Farwell gave judgment. He said that the Court below, without expressing any opinion of their own, considered themselves bound by the judgment of the Divisional Court in 1892, and followed it without demur. This Court was now asked to overrule that decision. The question turned on the construction of Sec. 211 of the Public Health Act, 1875, which, so far as was material, provided :—"The occupier of any land . . . used . . . as a railway constructed under the powers of any Act of Parliament for public conveyance shall be assessed in respect of the same in the proportion of one-fourth part only of such net annual value thereof." The section had received a good deal of judicial consideration of recent years. He thought the meaning of it had been explained by Mr. Justice Erle in South Wales Railway Co. *v.* Swansea Local Board of Health, thus :—"The general scheme of the enactment is that the occupiers of the classes of property most benefited by the expenditure of the district rates shall be liable to be rated at a higher rate, the occupiers of the

classes less benefited at a lower rate; and the class of property most benefited is that which is occupied immediately for the purposes of residence; and the kinds of property not so occupied are not to be rated so highly. Such is the general object of the Act; and we are now to apply its language to the particular case." Bearing in mind the Act, and the explanation given by Mr. Justice Erle, he thought the present case was best stated by reading Paragraph 8 of the special case. That paragraph stated:—"The tramway and light railway, as to the mode of construction and the materials used therein, are identical, and consist of lines of iron or steel grooved or slotted rails laid with the uppermost surface thereof level with the surface of the highway, and overhead wires suspended from posts placed alongside of, or in the middle of the streets, convey the electric power required for moving the carriages thereon. The carriages used upon the tramway and the light railway are the same carriages, and have flanged wheels running on the rails, and the same carriages used on the tramway run through and over the light railway for the conveyance of passengers and parcels thereon, as part of the common system. The charges authorised by the Acts and orders aforesaid, or some of them, are also applicable to both the tramway and light railway. The same carriages are moved along the rails, both of the tramway and the light railway, by electrical power on what is commonly called the overhead system." That showed, continued his Lordship, that the tramway and the light railway were identical so far as physical construction and appearance were concerned. The question which had to be considered was the meaning of the words in Sec. 211, "land used as a railway constructed under the powers of any Act of Parliament." There had been many decisions as to the meaning of "tramways." He thought the meaning had nowhere been better expressed than by Lord Shand in a passage which was quoted by Lord Dundas in Glasgow Corporation *v.* Assessor of Railways and Canals, and which was as follows: "A tramway is a species of railway, and railway and tram undertakings respectively take their name as such from the fact that they possess and use for the purposes of conveyance rails fixed in the ground but differing somewhat in form of construction. In the sense of the Valuation Acts, the Lord Ordinary is of opinion that a tramway company is included under the term railway company, which term is not limited to such railway companies as use locomotive power." It was true that that was a decision on a Scotch Valuation Act, but the subject matter of it was germane to the present case. There was another definition or statement by Lord Justice A. L. Smith in Williams *v.* London and North-Western Railway Co., which he also thought was a very good synonym. It was as follows: "When the Legislature deals with land 'used as a railway,' is it conceivable that it was intended to include a warehouse or shed not connected with a railway? Speaking for myself, I cannot put that construction on the Act. What was meant was a railway in the ordinary sense, that is, a line of rails connecting one place with another, over which goods and passengers are carried, and not such rails as those within these four walls." When the present case was brought within that definition it made no difference, as a matter of phraseology, whether the tramway was called a railway or not. Here the facts were that so far as the nature of the undertaking and its physical appearance were concerned, the tramway and the light railway were absolutely identical. There was no doubt that light railways were entitled to exemption under the section, because it had been so decided in terms by the House of Lords in Wakefield Corporation *v.* Wakefield and District Light Railway. It was said that the decision in that case depended on certain specific Acts dealing with light railways, and on the order authorising the particular railway. But that did not prevent the application of that case to the present one. In the first place, one of the points to be considered was a physical one—namely, as to the nature and appearance of the tramway. In its nature it was virtually a construction laid on rails, and it was not less a railway because it was light. The fact was that there was now no difference between light railways and other railways. Then it was said that the case of Swansea Improvements and Tramway Co. *v.* Swansea Urban Sanitary Authority was against the appellants' contention. He thought, however, that that decision could no longer stand. He thought the reasoning there was inconsistent with later authorities. The Swansea case was a case of a tramway communicating by points and switches with a railway. In that case Mr. Justice Wills said:—"The objection which has been taken on the part of the urban sanitary authority, and which, in my opinion, is a good one, is that tramways are something essentially different from railways, and that in the legislation of 1875, where railways are spoken of, they cannot possibly be supposed to include tramways." With all respect to the learned judge, he (the, Lord Justice) could not agree that tramways were essentially different from railways. When the user of land was considered with regard to the exemption from rating, he thought it was immaterial to consider what would be the user of a particular line of rails, except that it was to be for a railway—namely, for the purpose for which a railway was used. He was unable to find any ground for saying that the reasoning of the decisions in the Court of Appeal and the House of Lords did not govern the present case. When one had once arrived at the fact that the "way" in question was used exactly as a railway, and there was nothing in any of the Acts of Parliament in express terms to show that it was not to be regarded as that which it in fact was, he was of opinion that he was bound to follow the later authorities, and overrule the decision in the Swansea case of 1892. The case must accordingly be allowed.

Lord Justice Kennedy, in concurring, said that no doubt the decision in the Swansea case was in favour of the respondents, but in his view it was impossible satisfactorily to reconcile it with the later decisions of this Court, affirmed by the House of Lords.

Mr. Justice Warrington also agreed. He said the user was the user of the occupier, and they had to consider, not whether this was a tramway or a light railway, but whether it was used as a railway. It was beyond argument that the part of the system which was called a light railway was used only within the meaning of Sec. 211, and that being so, he failed to see how it could be said that that which was used in identically the same manner was not used as a railway. The Public Health Act did not say that a railway should be exempt and a tramway should not be exempt. What it did say was that land used in a particular way should enjoy this particular exemption. The decision of this case depended upon the fact found here—the identity of the user of the two parts. But it was said there was this distinction to exclude tramways from the exemption—that in one case the "way" was constructed under the Light Railways Act, and in the other case under the Tramways Act. The Public Health Act said nothing whatever as to the particular Act under which the "way" was to be constructed. It was simply to be constructed under some Act, and it seemed to him they would be introducing a false method of construction of the Public Health Act if they were to read into it some narrower meaning of the word "railway" than that which he had indicated. Obviously no person who did not know under which Act of Parliament this railway and this tramway had been constructed would be able to say whether one was a light railway or a tramway. He agreed that in view of more recent decisions the decision of 1892 could not stand.

The appeal was accordingly allowed with costs.

Baxter *v.* Mountstephen.

In the City of London Court last week, before Mr. Registrar Wild, a claim was made by Mr. Thomas Baxter, factor, Crosby House, Great St. Helens, against Mr. L. Mountstephen, trading in the name of L. Mountstephen & Co., electrical engineers, 51, High Street, Hounslow, Middlesex, for the price of three metal-filament lamps supplied.

The Plaintiff said he had obtained the order for the electric lamps in question from the defendant's wife, who managed the business while the defendant was away. He afterwards saw the defendant about the lamps and was told they suited him, and said if given a month's time he thought he would have a big order for him (plaintiff). On a subsequent occasion he called upon the defendant, who said he had no money for him. He (plaintiff) then said he either wanted the money or the lamps back. The defendant then said, "Not in these trousers," and danced round his shop, saying, "You will never get any money out of me."

The Defendant said the lamps in question were left as samples, and were not to be paid for. His wife had no authority to give any orders in his business, and if he had given any orders he would not have ordered three lamps.

The Plaintiff said that all lamps left as samples were to be paid for. That was the custom of the trade; he had evidence in Court to prove it.

After considerable discussion, the Registrar gave judgment for the defendant, and allowed him 10s. expenses.

Clague *v.* Burnley Corporation.

At Burnley County Court on Friday, Judge Graham delivered judgment in the arbitration between John Clague, Castletown, I.O.M., and Burnley Corporation. The case arose out of the death of the son of the applicant, the first mentioned having been burned to death in June, 1911, whilst repairing overhead wires as a worker in the electricity department. Compensation was claimed by the father on the ground of partial dependency. A sum of £130 was awarded.

Young *v.* South Shields Corporation.

At South Shields County Court on 8th inst., before Judge Bonsey, John William Young and his wife, Eleanor Ann Young, sought to recover £80 damages for alleged shock received by Mrs. Young through a flash of electricity caused by the fusing of an overhead tramway wire, on July 8th last.

Mr. H. S. Mundahl was for the plaintiffs, and Mr. E. Meynell was for the Corporation.

Mr. Mundahl, for the plaintiffs, said that on July 8th Mrs. Young was proceeding along the pavement round the corner of Fowler Street and King Street, and, as she was nearing the tramway standard there, a Corporation tramcar turned into Fowler Street from Ocean Road, when the trolley pole of the car came off the wire, and something happened, with a big flashing on the overhead wires. Mrs. Young was so alarmed that she almost immediately fainted, and she received a severe shock.

In reply to Judge Bonsey, Mr. Mundahl said he did not contend that it was an electric shock.

Mr. Mundahl, continuing, said that Mrs. Young became unconscious, and had to be taken home. She was under the care of a doctor for a considerable time, and was unable to resume her household duties for about four months. The plaintiffs had, in consequence, suffered loss through having to provide extra nourishment, medical attendance, and household assistance. The chief question that arose was, Were the defendants responsible for the damage? Counsel suggested that they were, because it was through negligence that the flashing was caused. A police officer, who was on duty near the spot, had made a report to the effect that the tramcar was rounding the corner when the

trolley came off and caught the "live" wire, causing sparks to fly. The trolley then caught the span wire, which broke, the end hanging about 6 ft. from the ground. Mrs. Young was about 10 yards away when she fainted, and on coming round she explained that it was the shock of seeing the sparks flying that caused her to faint. Correspondence had taken place, and the Town Clerk in a letter had stated :—"I am informed that the falling of the span wire was due to the trolley head getting accidentally jammed in one of the hangers or supports, and short-circuiting part of the overhead apparatus, with the result that the span wire was fused close to the pole, and was burned off and hung down loose from the hanger in the centre of the road. The mishap, I am instructed, was unavoidable." That, Mr. Mundahl said, plainly indicated negligence in two respects. There was quite obviously a possibility of the trolley wheel leaving the wire on rounding the corner, and the proper and usual precaution was for the conductor to pull down the trolley either by means of the rope, or by getting hold of the trolley itself from the top of the car while rounding the curve. Had that been done it would have been impossible for the trolley head to have got jammed in the hanger. Secondly, even admitting the fusing of the wire, this should have been harmless had the system been properly insulated.

Mrs. Young, the plaintiff, gave evidence, and stated that as she was turning the corner from Fowler into King Street, she noticed what seemed like a flash of lightning on her right side, and she remembered nothing more until she found herself at home. She was still in a very weak state as a result of the accident. She went to Harrogate to recuperate, and her holiday there cost £7 10s. She was unable to do her household work after the shock, and had to employ a maid.

Mr. Young also gave evidence.

Dr. Sutherland, police surgeon, said he was called in to see Mrs. Young, and found her suffering from acute nervous derangement. This was likely to be due to a severe fright in the case of a highly-strung person like Mrs. Young. He examined her on Saturday last in company with Dr. Gowans, and they came to the conclusion that she was practically recovered.

As it was intimated that the case was likely to last a considerable time, the hearing was adjourned till another Court.

Tramway Accident Claim.

An action has been settled in the Court of Session, in which the wife of an engineer sued the Dumbarton Burgh and County Tramways Co., Ltd., Dumbarton, for £500 damages for injuries received by her in a collision between two of the defenders' electric tramway cars north of the passing place at Millburn Brae. The pursuer has accepted £51 and expenses in full.

Re Davis Electrical Company (In liq.): Correction.

With reference to our report of the proceedings in *re* Davis Electrical Co., Ltd. (Electrical Review, January 19th, 1912), Mr. Howlett writes from Canada stating that the words "entitled to 7s. a week" are inaccurate. We have made inquiries from the solicitors to the petitioners in the case (Messrs. H. H. Wells & Sons, 17, Paternoster Row, London, E.C.), and we find that the correct amount was *seventy* not *seven* shillings. We regret that our reporter evidently misheard the statement of counsel.

The correct figure was given in our report of the meeting of creditors (see Electrical Review, November 3rd, 1911, p. 735).

Attorney-General *v.* Sheffield Corporation.

[*Municipal Trading in Electric Fittings.*]

On February 13th the action of the Attorney-General at the relation of Albert Davidson, engineer, of Norfolk Street, Sheffield, *v.* the Lord Mayor, Aldermen and Citizens of the City of Sheffield, came before Justice Eve in the Chancery Division.

Plaintiffs claimed a declaration that the defendants had no power to carry on the trade or business of erecting and installing electric light fittings and wires and electric bell fittings and wires in houses and other buildings or any part of such trade or business; a declaration that the defendants have no power to carry on the trade or business of selling motors outside the city of Sheffield; and a declaration that the defendants have no power to expend their moneys and use their plant, premises, machinery or servants for such purposes. Plaintiffs also claimed an injunction restraining defendants from carrying on such trades and from expending or using for such purposes any of the money, plant, premises, property or servants of the Corporation.

Mr. P. O. Lawrence, K.C., and Mr. M. Druequer appeared for the plaintiffs, and Mr. Danckwerts, K.C., and Mr. Sargant represented defendants, instructed by Mr. Rd. M. Prescott, the Town Clerk of Sheffield.

Mr. Lawrence, in opening, said the case involved a question that had been agitating the Courts before, namely, whether a Corporation under their powers could carry on the business of electric fittings contractors. What the Corporation had done in Sheffield was to open a showroom, practically a shop, in the municipal buildings, to which anybody could go and buy a lamp, a cigar-lighter and anything connected with electricity. It was not for the benefit of the inhabitants and ratepayers, because, if an American visited the town, he could go into the shop just the same as anybody else. They advertised, and this was the grievance of the whole thing which was taken up by the Contractors' Association. Defendants contracted with private individuals for the purpose of wiring their houses. As incidental to that, they not only did it for wiring for electric light, but they fixed up bell services, which was quite unconnected with electrical supply. They had done this inside and outside their area. By their defence they disclaimed any right to do it outside their area, but they had done it, and he should ask for an undertaking or injunction in respect of that. They had under an Act which they got in 1903 acquired power to supply electric motors in connection with the supplying of electric power. That was a special clause in a special Act of Parliament. The Bill sought to give them the powers which plaintiff said they could not exercise; but in consequence of opposition that was cut out, and it was confined to motors, and by virtue of their Act they had no right to supply them outside their area. In other words, they were carrying on trade in competition with the ordinary traders in the country, and, of course, at a great disadvantage to the traders, because defendants had the whole of the ratepayers' money behind them. It was quite immaterial whether they made a profit or loss, and they could under-cut, as plaintiffs alleged they had, all the contractors in the town for this kind of work. They might be able to do it at a profit. They said they did, but plaintiffs said they did it at a loss. That was a matter which might give rise to a great many difficult questions, because they did not know what money to allocate to what. In these big Corporation accounts it was very difficult to say whether, on a particular branch, any loss was shown or not shown. That was an outline of the story. It depended on Acts of Parliament and other matters. The same question arose before Mr. Justice Neville with the Corporation of Leicester, and Mr. Justice Neville gave his decision there in favour of persons in the same position as plaintiffs in this action. The same arguments would, no doubt, be repeated here. As he understood the case was not to rest there, but was to be taken up by either side as a test case of the matter to the House of Lords upon the main point that arose, which was the same as in Mr. Justice Neville's case, he apprehended his Lordship would adopt Mr. Justice Neville's construction, with or without an expression from his Lordship as to whether he approved of it or not. Then there was a further point in this case that was not in Mr. Justice Neville's case. The Corporation of Leicester were the original undertakers. In this case the Corporation of Sheffield had taken this undertaking over from a company which obtained a provisional order in 1892 under the Electric Lighting Acts, of 1882 and 1888. That company had carried on a wider business than was authorised by the statutory powers conferred on the Corporation, so a question might arise how far the Corporation, as successor of that company, were entitled to go beyond the statutory powers conferred by the Acts of 1882 and 1888. That was a point independent of Mr. Justice Neville's decision.

Counsel then referred to the sections of the Electric Lighting Acts of 1882 and 1888, relating to the matter, and said the plaintiffs' case was that the obligations of the Corporation ceased at the consumers' terminals. He exhibited a diagram showing the supply of current to the consumers' houses, and explained that the apparatus which was incidental to the supply was distinguishable from the fittings which were supplied for the use of the current.

At this stage the hearing was adjourned until February 15th.

Cavehill and Whitewell Tramways.

In the matter of an arbitration between the Corporation of Belfast and the Cavehill and Whitewell Tramway Co. which was at hearing for two days in the King's Bench, before Mr. Justice Gibson, Mr. Justice Boyd and Mr. Justice Kenny, judgment was given last week refusing to set aside an award made by Mr. Lynden Macassey, of London, by which he declared, after hearing evidence, that the price which the Corporation of Belfast ought to pay for the tramway undertaking of the company was £56,155. Mr. Macassey made and published an award in March, 1911, in which he declared that in arriving at the sum of £56,155 he had regard, not merely to the circumstances of the maintainable revenue which the transferred undertaking was capable of producing, and to the proper number of years' purchase of such maintainable revenue, but to all the other circumstances of the case to which he could properly have regard. Assuming that the construction contended for by counsel for the Corporation was the true construction of Article 1 of his agreement, and that the value of the said transferred undertaking was the value of it as a going concern, as contended for by counsel for the Corporation, he was unable, without further evidence, to decide what was the value of the undertaking as a going concern. The Corporation questioned the award, and the King's Bench Court made an order sending it back to the arbitrator, with directions to base his award on its value as a going concern. The arbitrator accordingly heard counsel on both sides, but no further evidence, and he made his second award, deciding that the value of the undertaking as a going concern—that was to say, as a rent or profit-producing or saleable undertaking—was £56,155, the exact figure of the first award. The Court refused the motion to set aside the award, with costs.

OUR LEGAL QUERY COLUMN.

[Questions addressed to this column should be written on one side of the paper only.]

"M.O.W." writes:—"When an electricity meter has been tested by the supply company, and the result shows the meter to be registering in excess of the 2½ per cent. permitted by the Board of Trade for a 5-amp. meter, can the consumer claim the full error, or only that in excess of the 2½ per cent?"

*** This question is to be answered by reference to the contract between the parties. It is obvious that if A pays 3d. a unit for electricity, he expects to get full value for his money—no more and no less. If the meter registers 5 units whereas only 4 have been consumed, he need only pay for 4. So long as the error does not amount to more than 2½ per cent. he has no remedy; but if it exceeds that amount, he is entitled to recover the whole amount which he has overpaid.

BUSINESS NOTES.

Pumping Machinery Contracts.—We have received a lengthy list of some of the orders recently booked by the WORTHINGTON PUMP CO., LTD., of London and Newark-on-Trent. The following are included:—

One complete condensing plant of the sub-base type having vertical triplex Edwards air-pump and lift pump. Also 14-in. twin centrifugal circulating pump for 8,000 gallons per minute, against 60 ft. head, driven by B.T.-H., of Rugby, steam turbine, for the Bradford Corporation Electric Light Station. This is the third condensing set supplied by the company for the same station.

One surface-condensing outfit for 16,900 lb. of exhaust steam per hour, with complete Worthington patent rotary combination of air and circulatin pumps, for export to Japan.

Two low-level jet condensing outfits, complete with Worthington rotative dry vacuum pumps and centrifugal circulating pumps, driven by vertical engines for 19,500 lb. of exhaust steam per hour with 28-in. vacuum, for shipment to Japan.

Two rectangular surface condensers, with single combined air and circulating pumps, together with one vertical single doub e-acting air-pump, ordered through the company's Berlin office.

Four natural-draught steel cooling towers, each to cool 125,000 gallons per hour, for Lister Drive power statio n of the Liverpool Corporation.

Three natural-draught cooling towers—two for 8,800 lb of exhaust steam per hour, and one for 6,600 lb. of exhaust steam per hour—and one fan tower for 13,800 gallons per hour, ordered through the firm's Buda-Pesth office.

One forced-draught cooling tower, to deal with 6,500 gallons per hour, for gold mine service.

One Worthington centrifugal boiler feed pump, for Dudley Corporation.

Stoker Contracts.—The following are included in a list just received of recent sales of stokers by the UNDERFEED STOKER CO., LTD.:—

	No. of stokers.	Class.
Rosyth Pumping Station	6	E
Central Electric Supply Co., St. John's Wood ..	4	E
Heckmondwike Urban District Council	3	E
Poplar Borough Council	2	E
Newcastle Electric Supply Co., Philadelphia ..	1	E
Yorkshire Power Co.	2	E
Belliss & Morcom	1	D
London General Omnibus Co., Walthamstow ..	2	B3
Hyderabad Mint	3	E
Cossipore	1	E
Gebrüder Sulzer, Winterthur	3	D

Prices Advance.—THE BRITISH THOMSON-HOUSTON CO., LTD., of Rugby, announce that, owing to the increase in the cost of raw materials, they are increasing their selling prices by reducing the discounts hitherto applying on their standard lists. A new index, giving particulars of price lists and discounts, is in preparation, and will be ready for distribution shortly. In the meantime, they will quote specially on application.

THE GENERAL ELECTRIC CO., LTD., also announce that, on account of the increase in the cost of raw materials, they are, from February 5th, charging a 10 per cent. advance on all prices contained in sections of their catalogue relating to the following:—Low and medium tension switchgear, switchboards, high-tension switchgear, starters and controllers.

Railway and Tramway Map for the Session of 1912.—MR. EDWARD STANFORD, of Long Acre, W.C., has, in accordance with his usual custom, published a coloured map showing the metropolitan railways, tramways and miscellaneous improvements of which particulars were deposited at the L.C.C. up to November 30th, 1911, and which will occupy the attention of Parliament in the approaching session. The price is 2s. in sheet, and 4s. 6d. mounted in case.

Rubber-Covered Wire for Canada.—The Imperial Trade Correspondent at Toronto (Mr. F. W. Field) reports that the Canadian Fire Underwriters' Association, of Toronto, have decided that after January 1st, 1913, they will not accept any electric wire except the new code rubber wire as specified in the 1911 National Electrical Code. This rule, Mr. Field understands, will probably be adopted by the other fire underwriters' associations throughout Canada.—*Board of Trade Journal.*

A copy of the 1911 National Electrical Code may be seen at the ELECTRICAL REVIEW office.

France.—La Société Française des Lampes Reparables "Sol" is the name of a new company which has lately been formed in Paris with a capital of £20,000, to manufacture an improved metal-filament lamp. At first an annual output of 200,000 lamps is being arranged for, but it is hoped to quickly increase this to a million.

Consular Notes.—Paraguay.—The British Consul at Asuncion reports that the market for British goods of certain kinds is no doubt capable of considerable expansion. In most branches goods of a low grade are in demand, but there is also some demand for goods of better quality. The greater part of the import trade is carried on at Asuncion, the provincial towns being dealt with by the travellers of the Asuncion houses, but a few of the other towns are worth the attention of British travellers. Commercial travellers require to take out a licence, the fee for which varies from £17 to £78, according to the importance of the firm represented. The travellers of firms who are already represented by agents do not require a licence. British firms doing business with Paraguay would be well advised to have their names and trade-marks registered at the office established for the purpose, for if their names or marks should be registered by unauthorised persons the firms lose the right to sell their manufactures under their own names and marks. The ordinary cost of registration, including the publication of a description of the mark as required by Paraguayan law, is about £5, but where it is necessary to publish very long descriptions of marks and printed labels the charges would be higher. The import trade in Paraguay is in the hands of a limited number of firms (chiefly foreign firms established at Asuncion) and of agents of foreign houses, who import direct from Europe, or who buy goods of European origin from large houses in Buenos Ayres and Monte Video. In some of the provincial towns also there are firms which import direct from Europe and from the neighbouring Republics. The usual terms given are six months' credit from the date of the invoice, but some European houses give eight or nine months' credit. In some cases it is customary to give a credit of eight months for one half of an order and six months for the other half. The credit is generally subject to interest at the rate of 6 per cent. per annum from the date of the invoice. As the local banks charge 12 per cent. interest on advances the importers are naturally disposed to avail themselves of the long credit offered.

Philippines.—The British Consul at Manila reports that the trade of the Philippines in the heavier class of machinery, steam engines, &c., is practically divided between the United States and the United Kingdom. The trade in petrol motors and electrical machinery is controlled by manufacturers in the United States, and there has been a considerable increase in business in these articles.

Russian Far East.—The British Consul at Vladivostok, in a recent report, states that it is difficult to find any ground for self congratulation when surveying the trade done in articles of British manufacture in his region. Our share in imports continues to be disappointingly small and, what is worse, there are no signs apparent of any determined intention on the part of our manufactures to improve their position. Yet this is a new country of enormous area on the immediate development of which vast sums of Government money are being spent, and through which a railway is now being driven, at a probable eventual cost of something like £30,000,000. At the time of writing, 10 steamers with general cargo from Antwerp and Hamburg had cleared from Vladivostok for Nikolaievsk, taking some 20,000 tons of cargo, nearly all of which consisted of salt, machinery and general contractors' stores. With the exception of large consignments of iron sheets—bought through commission agents on the Continent—the proportion of our manufactures in this amount is negligible. That this should be so is a proposition that few will be found to dispute. It gives rise to two obvious questions—why is it the case, and what can be done to remedy it? The answer to the first question is simple enough—we have no share, or next to no share, in Siberian trade, because we have never taken the trouble to organise business connections; because British firms, either from ignorance or from indifference, have not considered it worth while to establish themselves locally or to secure efficient representation in the country, contenting themselves with such few orders, as, without any effort on their part, happened to come their way. The results have been disastrous in more ways than one; trade has not developed, openings, from lack of knowledge of local conditions, have been wrongly handled, and an unduly large number of unsuccessful transactions have been made which have not only discouraged the firms directly concerned from further enterprise, but have induced a general mistrust of Siberian business as a whole. Nor is the answer to the second question far to seek. Our merchants and manufacturers will have their proper share in Siberian business when they have made up their minds to follow the excellent example shown to them by the Germans in past years—namely, to open up for themselves in the country and to organise, even at the risk of making a loss for the first year or two, a systematic scheme of commercial operations.

British manufacturers, if they hope to build up a trade of any consequence in this country, have to make up their minds to allow their customers more favourable conditions of credit than they countenance at present. It must be borne in mind that Eastern Siberia is very sparsely inhabited by a population of very modest means, and that the credit system is to them an absolute necessity. This applies to commodities of all kinds, and to peasants and retail and wholesale dealers. With the exception of one or two German firms who pay cash, all the local houses require credit for from three to nine months, extending sometimes to double that time. For the sale of machinery and mechanical outfits, &c., the instalment system is in current use, the period of payment ranging

over three years. The reason for the prevalence of the credit system is to be sought in the dearness of money and the fact that the capital in the country is generally insufficient for its needs. The rate of interest charged by banks on borrowed money has recently fallen, but even now it is from 9 to 12 per cent. Under these conditions buyers naturally prefer to obtain credit from their suppliers, even on equal terms; suppliers, on the other hand, profiting by European rates of interest, find an advantage in extending credit to their customers at the high local rates. It is evident that in order to be able to engage in this business at all, manufacturers must have a much closer personal acquaintance with the market than is at present the case, and that, for this purpose, they must be represented locally by competent agents in whose knowledge of the conditions and of Russian commercial law and practice they can rely. Travellers in British goods are very rare, and those who do visit these parts are generally handicapped by a complete ignorance of the Russian language. They are also, as a rule, poorly provided with samples and not prepared to spend sufficient time in the country. Broadly speaking, they do not appear to tackle their work in the thorough and systematic manner characteristic of the German traveller, who will have with him ample printed matter, will quote c.i.f. prices, accord such conditions of credit as local circumstances require, and supply, when necessary, the elaborate blue prints to which the Russians are so attached. It is a fallacy to suppose that Russian law does not protect creditors. On the contrary, they are probably better protected in Russia than in most other countries. Firms trading here with the essential local knowledge that German firms possess, experience surprisingly few losses, and, though the exaggerated terms of credit which are prevalent are hard to become accustomed to, yet it is certain that, unless the effort is made, this market must remain practically a closed one to British goods,

Later in his report the British Consul says that the question of an electric tramway for Vladivostok has been settled; two local contractors received a 10 years' concession to construct and run a double line of some 5 miles length from the railway station, and along the main street to the eastern extremity of the town. The rails are supplied by the town, power is to be purchased from a central station which is being built, and which will also provide light for the streets and for general use. The rolling stock, cables, machinery, and all other outfit for the tramways, as well as for the power station are to be supplied by German firms, the poles alone, it is believed, coming from America. British firms have no particular reason to be grateful to the municipality for the treatment accorded to them in this connection. Several of them have spent no little time and money in conducting negotiations with the Vladivostok Town Council with a view to obtaining the execution of the various improvements of which the city stands so much in need. Yet the call for tenders for building the central power station was announced so short a time before the adjudication that it was a matter of practical impossibility for any firm *not locally established* to compete.

Towards the end of 1910 wireless telegraphic communication was opened between Petropavlovsk in Kamchatka and Nikoleivsk—a distance of 800 miles. The station at Petropavlovsk was burnt down shortly after it commenced operations, and only temporary arrangements could be made for carrying on the service. Consequently the communication has been intermittent. As there is no postal service to Kamchatka during the winter months, the installation of wireless telegraphy will be of great value to the country, both administratively and from the point of view of the general public. The use of wireless telegraphy is being largely extended, and it has been decided to erect in due time the following stations: (1) On Behring Island; (2) at the mouth of the River Anadyr; (3) at Providence Bay and on Cape Dyejneff in the Tchukotsk Promontory; (4) at Markova, on the Anadyr River; (5) at Okhotsk, Yamsky, Ghidjiga and Tighil on the Sea of Okhotsk: (6) in Sakhalin, to ensure communication in case of the present cable being interrupted; (7) at Herbinski (on the Amgun). The stations in Ghidjiga, at the mouth of the Anadyr, and in Sakhalin should be working in 1912.

British Columbia.—In a recent issue of the *Electrical Record* (U.S.A.), it is stated that A. B. Kennedy, electrical contractor, of Merritt, British Columbia, reports an active and profitable electrical contracting business in that part of the country. At present he has in hand a contract for electrically equipping the new $25,000 Nicola Valley General Hospital, also a cold storage plant for the Nicola Valley Meat Market, besides several other small contracts. The Nicola Valley Meat Market is having a 30-volt storage battery plant installed for lighting its premises, which consist of a coal storage plant, a large meat market, and an opera house. Mr. Kennedy also has a contract to install a 230-volt direct-current water turbine plant for the town of Lower Nicola. Mill Creek will furnish the motive power. This plant is being installed for D. Dodding, a prominent rancher and dairyman, who has also a branch of the provincial experimental farm on his ranch. In addition to supplying light for his dairy and home, Mr. Dodding will be able to provide the little town with light and power.

Private Arrangement.—C. Suckling (trading as G. Suckling & Co.), electrician, Brent Street and Golder's Green Road, Hendon.—A meeting of the creditors interested in the above matter was held on Monday last, when the representative of the Amorduct Co. was elected to the chair. The statement of affairs presented showed total unsecured liabilities of £853, of which £488 was due to the trade, while £365 was due to cash creditors. The cash creditors were the debtor's father and mother and a Mr. Carpenter. The assets were estimated to produce £258, and consisted of stock £118 and book debts £140. The debtor attributed his present position to the failure of a local builder, who owed him an amount (£130), and also to pressure by several creditors. A writ had been issued last week for £163. It was stated that the debtor was formerly in business in partnership, trading under the style of Brock & Suckling. This partnership was dissolved about 18 months ago, the debtor paying the liabilities of about £400, and taking over the assets estimated at a like amount. He had received assistance from his father, and had been mainly engaged in electric wiring work for builders. There were no particulars available with regard to the turnover or gross profits, but the debtor's drawings had averaged about £2 per week. There was no life policy, but the debtor said there were two houses situated in Temple Grove, Golder's Green, which he had purchased from a Mr. Bernstein, through a building society, about two years ago, for £500 each, but debtor thought he had only paid the interest. Debtor made an offer of 3s. 4d. in the £ cash down, the cash creditors withdrawing their claims. This offer was discussed, but no conclusion was arrived at in the absence of the principal creditors, and the meeting was adjourned. The debtor's father, who is the largest cash creditor, is in a small way of business, and has evidently helped the debtor to the full extent of his power. The following are creditors:—

Armorduct Co., Ltd.	£141	Haymills, Ltd.	£27
Veritys, Ltd.	165	Bernstein, H.	49
Thomas, F., & Co.	42	Suckling	310
General Electric Co., Ltd.	25	Suckling, Mrs.	30
B.T.-H. Co., Ltd.	41	Carpenter	25

Bankruptcy Proceedings. — Bertram Newman (trading as B. Newman & Co., described in the Receiving Order as Bert Newman, trading as B. Newman & Co.), electrician, 4, Cranbrook Road, Ilford, Essex.—The adjourned public examination of the above-named debtor was held at the Shire Hall, Chelmsford, on Wednesday last, when the statement of affairs showed liabilities amounting to £850 and a deficiency of £847. The debtor attributed his failure to bad debts. He estimated his losses on that account at over £630. After a short discussion, the examination was ordered to stand adjourned.

Charles Oldham McMillan, electrician and cycle dealer, Portmadoc.—Receiving order made on February 10th, on debtor's own petition.

Dissolutions and Liquidations.—C. G. Reed & Sons, Ltd., North Road, Brighton, ironmongers and merchants.—This company recently went into voluntary liquidation, and the following appear in the list of creditors:—

Bullers, Ltd.	£18	Moeller & Condrup, Ltd.	£59
The Electrical Co., Ltd.	23	W. Soutter & Sons	48
Krupka & Jacoby, Ltd.	158	Stein (?) Electric Light Co.	27
J. Russell & Sons	398	R. Hornsby & Sons	27
Evered & Co.	383	Henley's Teleg. Co., Ltd.	32
Falk, Stadelmann & Co.	76	Simplex Conduits, Ltd.	58
Siemens Bros. Dynamo Works, Ltd.	93	Brimsdown Lamp Works	25
R. A. Lister	39	Sun Electrical Co., Ltd.	33

Bombay Hydro-Electric Syndicate, Ltd.—A meeting will be held at Gresham House, E.C., on March 11th, to hear an account of the winding up from the liquidator, Mr. F. J. Horne.

Rose's Recording Target Co., Ltd.—This company is winding up voluntarily, with Mr. J. Leith, 85, Gracechurch Street, E.C., as liquidator. A meeting of creditors is called for February 22nd, at 13 and 14, Abchurch Lane, E.C.

Catalogues and Lists.—Mr. George Ellison, Victoria Works, Warstone Lane, Birmingham.—Leaflet containing description, illustrations and prices of the firm's new totally enclosed drum type plain "star-delta" starters for squirrel-cage three-phase motors.

The Electrical Engineering and Equipment Co., Ltd., Bank Buildings, 109-111, New Oxford Street, London, W.C.—New pamphlet of 16 pages, wherein are given particulars with illustrations (half-tone and diagrammatic) concerning their type "L" high lift centrifugal pumps, also notes on their starting up and operation. One of the views shows a 1,250-H.P. colliery pump driven by a three-phase 5,000-volt motor, a waterworks high lift pumping set driven by a three-phase 360-H.P. motor, underground mine pumps, sinking pumps for mines, water supply plants for industrial districts, &c. Other publications just issued by the same firm are as follows:—No. L 2, giving a list of prices of "Leanda" metal-filament lamps from 25 to 260 volts and from 9 to 900 British C.P.; and List No. P.M. 3, containing illustrated descriptions, with tabulated particulars including prices and weights, of electrical measuring instruments, moving coil and hot wire; wattmeters for D.C. or A.C., three-phase wattmeters, and other kindred manufactures.

Messrs. Siemens Brothers Dynamo Works, Ltd., of Tyssen Street, Dalston, N.E., have just issued a "Wotan" lamps show-card of effective design lithographed in nine colours. It is mounted on a stiff board, and contractors who have not yet received one can have a copy on application. At the bottom it carries the words, "Drawn Tungsten lamps; save 15s. in the £; no lamps take less current."

Mr. Robert R. Steel, 794, Salisbury House, London Wall, E.C.—Pamphlet setting out the advantages of the "Alekin" improved automatic distilling apparatus for producing pure distilled water for a variety of purposes, especially for use in connection with storage batteries, and giving directions for connecting and working the apparatus.

The Diesel Engine Co., Ltd., 179, Queen Victoria Street, London, E.C.—Thirty-two page brochure containing an imposing tabulated list of purchasers of Diesel engines in Great Britain and Ireland, India, Argentine, Brazil, Chile, Mexico, Japan, China, Australasia, Egypt, &c. Information is given as to the number of cylinders and the B.H.P. in the case of each order. Copies of this publication will be sent to any applicant.

The Walsall Electrical Co., Ltd., 57, Bridge Street, Walsall.—Twenty-page catalogue of meters for direct and alternating current including the following:—Moving coil ammeters and voltmeters (improved Weston type); sector cased and edgewise ditto; the B 6 moving iron type meter; handy meters for testing purposes; railroad meters; moving iron meters; the "Export" meter; leakage indicators for mines; master switches; series and potential transformers; watertight and motor car duplex meters. Illustrations appear and prices are very clearly tabulated.

Messrs. Hick-Diesel Oil Engines, Ltd., 11, Queen Victoria Street, London, E.C.—Sixteen-page pamphlet describing the Hick-Diesel oil engine, giving an explanation and description of a typical installation, accompanied by half-tone and line diagrams. Dimensions are tabulated. The engines are made by Messrs. Hick, Hargreaves & Co., Ltd., of Bolton.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—Catalogue of 32 pages containing brief notes regarding, and illustrations of, Barwick motor starting and regulating gear, together with very fully tabulated lists of prices of upwards of 2,000 starters and regulators. The contents include prices of ½-minute rating starters of open, semi-enclosed and totally-enclosed types, together with 1-minute rating starters of the same pattern, starting panels and automatic starters. The prices of shunt regulators cover a very wide range, and prices also appear of patent shunt regulators having all live parts mounted at the back of the slate, doing away with the necessity for a front covering. A view is given of the switch mounted on the back of the slate before the resistance is connected to it. Various resistances for cinematograph theatres, and liquid resistances for theatres, are also listed.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—New edition of the firm's "Osram" lamp price list of 28 pages. Conditions of sale, and instructions for handling and use, and tables for dimensions of pear shape, round bulb and candle-shape lamps, precede neat illustrations with brief particulars and prices of various types of lamps with wire-drawn filaments. Two entirely new lamps included are the 200 and 260-volt, 20-watt, 16-c.p. and the 100 to 135-volt, 11-watt, 10-c.p. The number and ranges of candle lamps have been increased, and these are now stocked in twisted, as well as plain, flame and other shapes. Osram striplite lamps suitable for all kinds of trough reflectors are also shown; these will shortly be made in 100 to 135-volt, 16-c.p. type. Another item in the pamphlet is lamps specially designed for use in motor-car headlights. We understand that considerably over five millions of Osram lamps with drawn-wire filaments are now in use in this and other countries.

The Sterling Telephone and Electric Co., Ltd., 200, Upper Thames Street, London, E.C.—Publication No. 184 (24 pages) deals with Sterling electric blasting machines. The ground covered may be indicated thus:—Electric fuses for high and low-tension systems; electric blasting machines generally; "Sterling" patent electric blasting machines and instructions for using them; how to fire shots by electricity. Illustrated notes and prices appear of magneto high and low-tension blasting machines; dynamo low-tension blasting machines; shot-firing cable and cable reels; galvanometers and spare parts.

Book Notices.—*Four-Place Tables.* Compiled by E. V. Huntington. London: E. & F. N. Spon. Price 3s. net.—This is a handy set of tables of logs and trigonometric functions, bound in flexible cloth, and with a thumb index leading directly to the sections desired. All the values of any one function are found at one opening. The functions always increase from left to right, to prevent errors in interpolation. Additional thumb indexes are provided at top and bottom to facilitate the use of the tables with the left hand only, but by some chance those in our copy have been wrongly cut, and fail in their object. Logs from 1 to 2 are given in a special table, direct reading; from 1 to 10 with differences for the fourth figure. Similarly, the logarithmic functions are given in special tables for the first or last 10°, as well as the ordinary tables from 0 to 90°, and various conversion tables are included, with a number of useful constants. The tables and notes have been carefully drawn up with a view to handiness and accuracy in use, and appear to be exceptionally convenient for quick working.

The Magnet Magazine. Vol. I, No. 1. Price 1s.—This is the first copy of the new magazine of the General Electric Co., Ltd., who are to be congratulated upon its excellent start. The fact that it is edited by Mr. M. Solomon (manager of the Witton carbon works of the G.E. Co.) is ample guarantee that a high literary and technical standard will be maintained, and the style and contents of the first issue are worthy of high commendation. The opening article is appropriately devoted to a biographical sketch of the late Mr. G. Byng, the founder of the company, whose portrait forms the frontispiece. The chairman, Mr. H. Hirst, contributes an extremely interesting foreword describing the recent expansion of the company, which now includes between 30 and 40 separate organisations at home and abroad, all controlled from one centre. Emphasis is laid upon the establishment of subsidiary companies in the principal external markets—Australia, India, China, Spain and South Africa, and, shortly, Argentina. This step was resolved upon some years ago, with the cordial support of the late chairman, and was due to the necessity of keeping the Witton factories fully employed, the home market being too limited in scope and unstable in character to afford alone a satisfactory field of enterprise. To this end the company entered into partnership with its foreign agents where practicable, while in other cases new companies were formed for the purpose. This policy has been fully justified by the results, which have already proved eminently satisfactory. An article on Paper-Mill Driving, an editorial explaining the scope and objects of the magazine, and a list of the Overseas companies and agencies of the G.E.C., complete the list of contents, which are of exceptional interest and quality.

The Modern Locomotive. By C. Edgar Allen. London: Cambridge University Press. Price 1s. net.—This is an addition to the admirable series of "Manuals of Science and Literature" in course of issue from the Cambridge University Press, and fully maintains the high standard of excellence set by its predecessors. It deals solely with the steam locomotive, the theory and practice of which are concisely but clearly outlined, with good illustrations.

"Macchine Dinamo-Elettriche e Trasformatori Statici." 1912. Milan: Biblioteca die Elettricita.

"*Transactions* of the Illuminating Engineering Society." Vol. VI, No. 9. December, 1911. Easton, Pa.: The Society. Price 75 cents.

"*Proceedings* of the Engineers' Club of Philadelphia." Vol. XXIX, No. 1. January, 1912. Philadelphia: The Club.

"*Transactions* of the University of Toronto Engineering Society." Vol. V, No. 3. Toronto: The University.

"Calcul et Construction des Alternateurs." By H. Birven. 1911. Paris: Gauthier-Villars. Price 6 fr.

"Review of the Coal Trade in 1911." London: The *Colliery Guardian*. Price 1s. net.

"L'Année Electrique Electrothérapique et Radiothérapique, 1911." By Dr. Foveau de Courmelles. Paris: Ch. Beranger. Price 3.50 fr.

"Science Abstracts." Sections A and B. Vol. XV, Part 1. January 31st, 1912. With Indexes to Vol. XIV. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Diesel Engines for Land and Marine Work." By A. P. Chalkley. 1912. London: Constable & Co. Price 8s. 6d. net.

"The Universal Electrical Directory (J. A. Berly's), 1912." London: H. Alabaster, Gatehouse & Co.

New Osram Lamps.—In issuing a new list of Osram lamps with drawn-wire filaments, the General Electric Co., Ltd., claim that these filaments are not surpassed in strength by any other make of lamp; transit troubles are now eliminated. An interesting novelty is the low-candle-power lamp, which is now available in two types—200-260 volts, 20 watts, 14·5 c.p., and 100-135 volts, 11 watts, 9 c.p. We illustrate herewith one of the former, which it will be seen is pear shaped and shorter than the lamps of higher candle-power. The filament is wound on the supports in one continuous length. The introduction of these

Osram Drawn-wire Lamp.

new types extends the range downwards almost to the lowest limit required in practice, and illustrates once more the extraordinary progress which has been made in the rapid evolution of the tungsten lamp. A test carried out at the National Physical Laboratory last year on nine 32-watt, 200-volt Osram lamps shows that they all burned for 2,000 hours and were unbroken at the finish, the average efficiency being 1·39 watts per horizontal candle during that period, and the falling-off in candle-power only 8 per cent. Such figures would have been regarded as hopelessly unattainable but a few years ago.

Trade Announcement.—Mr. W. Pagden Perry, of 6, Holborn Viaduct, E.C., has been appointed sole agent for London, the Home Counties and South-East Coast for the P. & G. electric heating and cooking apparatus. He is just introducing a new line in copper kettles with cast-brass scroll legs, especially to meet the views of the electric supply engineers. At the above address, we are informed, he is showing electric ovens on a new principle.

Indicator Approved.—The B. of T. has approved of Fricker's maximum-demand indicator as deposited by Messrs. Fricker & Miller, 82, Victoria Street, S.W.

LIGHTING and POWER NOTES.

Abingdon.—At the quarterly meeting of the T.C., a report from the Electric Lighting Committee was received stating that an application for a provisional order had been sent to the B. of T., and that the Committee had since had an interview with a representative of a firm willing to form a company to be called the Abingdon Electrical Supply Co., Ltd., and to establish an installation. The Committee was still in negotiation. The Mayor said that, from what he knew of the opinions of individual members, the Committee was against an electrical undertaking as a municipal enterprise, but would prefer a company to carry it on, and he shared that opinion. The report was adopted.

Atherton.—The L.G.B. has sanctioned loans amounting to £3,500 for the purposes of electric lighting for the D.C., viz., a loan of £1,500 for mains, repayable in 25 years; a loan of £1.000 for services, repayable in 15 years; a loan of £200 for switchgear, repayable in 17 years; a loan of £700, for transformers and transformer pillars, repayable in 15 years; and one of £100 for meters, repayable in five years.

Bath.—The T.C. has received the sanction of the L.G.B. to a loan of £8,000 for the installation of a Diesel engine, motor-alternator and booster.

Blackpool.—The T.C. has decided to oppose a Bill for confirming certain agreements under the Electric Lighting Act, 1882, between the National Electrical Construction Co. and certain local authorities.

Canterbury.—Once again the merits of gas *versus* electricity have been troubling the minds of the Guardians of the Canterbury Workhouse. A few months ago it was decided that electricity should be substituted for gas in the workhouse. At the next meeting, however, the matter was again brought forward, and after a keen fight gas carried the day, and it was decided to stick to the old method. At the meeting on January 29th a resolution was passed that electricity should be laid on to the new home which the Guardians are building for the nurses employed in the infirmary, one the members remarking that the laying of the cable to the home would pave the way for the adoption of electricity in the house. Mr. S. S. Warren, however, gave notice that he would bring forward a motion to rescind the resolution. Accordingly at the meeting this week the matter was again discussed. Mr. Warren dwelt at some length on the merits of gas *versus* electricity, and contended that the former was much healthier and cheaper. Several members spoke in favour of electricity, and eventually on being put to the vote, the motion was lost by a large majority, only two voting for gas.

Cheltenham.—The R.D.C. has given consent to the T.C. to supply electricity to premises in the rural area, without prejudice to the R.D.C.'s right of action as regards all future applications.

Cheshire.—The Chester County Council has decided upon an electrical installation in the buildings of the Bache Hall Estate, the Hall itself to be utilised as a nurses' home in connection with the Upton Asylum.

The Council has decided to petition against the Altrincham and Bowden E.L. (Extension) Order.

Clacton-on-Sea.—After tests with gas and electric lamps the U.D.C. has decided to light the west front with 10 electric arc lamps.

Negotiations are proceeding with reference to a supply of electricity to the new home being erected in Holland Road, for the Reckitt's Home trustees. The latter have agreed to guarantee for at least two years an annual consumption equal to £50 a year. On a final decision being arrived at the necessary mains will be laid by the U.D.C.

Colchester.—The T.C. has decided to oppose by memorial the Bill that is being promoted to enable railway companies to supply electricity to private consumers.

Congleton.—The B.G. has decided next month to discuss the question of lighting the workhouse either by electricity or gas, dispensing with the present oil lamps. In the meantime expert advice is to be sought.

Crewe.—The Corporation proposes to borrow £1,925 for new electricity mains, £1,127 for additional plant at the generating station and £550 for other expenditure in connection with the electricity undertaking.

Devonport.—The T.C. has applied to the L.G.B. for a loan of £9,983 for additions to the electricity plant.

Dover.—The T.C. has decided to ask Mr. Wyndham, M.P., to block the Bill which seeks to give railway companies power to supply electricity to private consumers.

Epsom.—The U.D.C. has decided to install at the electricity works a 200-KW. Diesel engine, at an estimated cost of about £3,000.

Farnworth.—At the meeting of the D.C., held on February 7th, it was decided to petition against the Bill which the L. and N.W. Railway Co. are promoting, which would enable them to supply electricity to works near their railways. The chairman observed that the Bill would allow the company to compete unfairly with local authorities.

Formby.—Notice appears in the *London Gazette* of the revocation of the 1907 prov. order.

Gloucester.—Unless the city is exempted, together with the agreement of October 30th, 1899, the T.C. will petition against the Bill of the National Electric Construction Co., Ltd., which seeks to confirm free-wiring agreements.

Halifax.—At a meeting of the T.C. held on the 7th inst., the recommendation was adopted of the Tramways and Electricity Committee of a revised scale of charges for electrical energy for motive power purposes. The new scale will enable large consumers to obtain a supply of electric power at practically ½d. per unit. An amendment referring the question to the Finance, Electricity and Gas Works Committee for consideration was defeated.

Hazel Grove.—The Stockport T.C. has decided to apply to the B. of T. for an order empowering it to supply electricity to the Woodlands Estate, which is in the area of the local U.D.C. The latter body recently declined to consent to the T.C.'s application.

Kirkcaldy.—The electrical engineer, in a report to the T.C., states that he has been considering the question of the best type and size of plant for extensions at the electricity works. Under present conditions, with six non-condensing high-speed steam engines, there was no doubt the proper type of plant to install was the mixed-pressure turbo-generator. The total capacity of the existing plant was 1,100 KW., and he advised that the turbine should be of 1,000 KW. They would require a condenser and cooling tower, and he estimated the cost at £9,000. Mr. Francis has been instructed to prepare plans and specifications and to advertise for tenders. The Corporation electricity works, it may be added, are progressing rapidly, and the large extension is absolutely necessary.

Leith.—The Dock Commission has accepted an estimate by Sir W. G. Armstrong, Whitworth & Co., Newcastle-on-Tyne, for the erection of a 15-ton travelling crane at the new graving dock. The crane will weigh 150 tons, and is to lift 15 tons at 60 ft. radius. It is to be self-propelling and fitted with electric motors. The cost is £4,100, and the special track necessitated will probably cost £1,000.

Lincoln.—At a meeting of the City Council the other night, Mr. W. S. White moved that application be made to the L.G.B. for sanction to borrow £12,500 for the purpose of extending the plant at the electricity works. This was agreed to and the Committee's recommendation was confirmed.

London.—WOOLWICH.—The B.C. has sealed an agreement with a local firm in a district where mains are not yet laid for the supply of electric power on a three years' agreement. The capital expenditure involved is about £2,500.

Luton.—With reference to the Bill of the London and North-Western Railway Co., which runs through the town, seeking powers to supply electricity to any manufactory, works or premises adjoining or near to any part of the company's lines, the T.C., in Committee, has given the Parliamentary Committee powers to take what steps are called for in the matter to protect the interests of the Council's undertaking, and, if necessary, to lodge a petition against the Bill.

Maidenhead.—The T.C. has decided, with a view to a 200-KW. Diesel plant being installed at an estimated cost of £4,000, that the Chairman of the E.L. Committee and the engineer shall visit the works of Messrs. Carels Frères and examine the proposed plant. The L.G.B. is to be asked to sanction the use of £2,200 for the renewals reserve fund, and to raise the balance by loan.

Malvern.—The U.D.C. has decided to give power consumers a discount of 5 per cent. off the present price of 3d. per unit, on payment of account within 28 days.

Newcastle-under-Lyme.—The T.C. has decided to install at the electricity works two 150-KW. Diesel oil engines in preference to gas engines.

Nottingham.—A great deal of correspondence has been published in the Nottingham papers relative to the price paid for coal at the electricity works, one of the city auditors having called attention to it. A letter written by Mr. W. Bardill remarks upon the Corporation electricity plant as being a by no means modern one, and goes on to say:—"But the fact rests that the present plant is there, and until the Corporation can afford to put down a modern plant, situated where coal is at hand and where water is plentiful for condensing (say on the side of the Trent near to Clifton Colliery), and the plant specially adapted to use the cheapest form of fuel, there is no doubt that the Corporation officials, with the Committee, are doing all they possibly can in the interests of the ratepayers generally."

Penmaenmawr.—The U.D.C. has received the consent of the L.G.B. to a loan of £196 for extending the electric lighting of the promenade.

Perth.—The Corporation Electricity Committee is to apply for borrowing powers to the extent of £8,000. The department will in the near future require to meet the demand of two large new consumers—the new infirmary and the new premises of Messrs. John Dewar & Sons. The cost of the mains alone will be £3,500.

Plymouth.—The Hoe and Parks Committee of the T.C. proposes to illuminate electrically the Hoe, which is stated to be the finest promenade in Europe. The whole of the asphalte paths are to be lined with festoons of electric light—red, white and blue—which will have a charming effect. It is also suggested that there shall be three trellis archways over the entrance at the top of Lockyer Street. It is further proposed to illuminate the entrance by the lodge in Citadel Road, as well as at the entrance at the top of Windsor Lane. The bandstand, Smeaton tower, and the Armada memorial will also be electrically decorated.

Radcliffe.—In order to give a supply of energy in bulk to Radcliffe U.D.C., and to the new works of the Co-operative Wholesale Society, the Bury T.C. has applied to the B. of T. for permission to utilise overhead lines.

Reddish.—The Stockport electrical engineer is in communication with several large firms at Reddish with reference to their taking a supply of electricity from the Corporation. If the demand is satisfactory the mains will be extended to the township, and additional generating plant installed.

St. Anne's.—The Electricity Sub-Committee of the D.C. has under consideration proposals for reducing the price of energy for heating and cooking.

Sheffield.—The estimated amount of profit from the tramways undertaking for the year ending March 25th, 1913, which will be available for the relief of the district rate, has been put by the Tramways Committee at £19,238, as against £23,334 for 1912. With regard to the electric lighting department, the Committee put the estimated surplus for the years 1912 and 1913 at £4,142 and £2,902 respectively. The estimate of the tramways general manager and the surveyor of highways of £53,700, has been approved as the capital expenditure for rolling stock, plant, equipment of line, &c., for the 12 months ending March 25th, 1913. A Sub-Committee of the Watch Committee have had under consideration the proposals of the electric supply department regarding the substitution of electric lighting for gas lamps in the public streets. The claims put forward by the department in support of this proposition are (1) that the light is not concentrated at the base of the posts; (2) there is no partial failure of a lamp. The failure of a lamp would necessitate its immediate renewal assuring the maximum amount of light being constant; (3) the light is not effected by high winds; and (4) that improved lighting is obtained with no increase in the annual charges over and above that paid at the present time. It was further pointed out that the comparative capital costs for brackets, fittings, &c., including 10s. for labour, &c., but exclusive of posts were (*a*) lamps per post; four (*b*) gas, £7 1s. 10d.; (*c*) electricity, £5 17s. 6d.; (*a*) three (*b*) £6 16s. 10d.; (*c*) £5 11s.; (*a*) two (*b*) £5 6s. 4d.; (*c*) £4 18s. 2d.; (*a*) one (*b*) £2 6s. 10d.; (*c*) £2 6s. 10d. Taking these figures into consideration, the Sub-Committee state that whilst they show that the capital cost for the electrical equipment is less than for gas lanterns, fittings, &c., it should be borne in mind that the Watch Committee had already incurred a cost equivalent to the proposed capital cost for electrical equipment, and that the cost which had already been incurred was giving fairly satisfactory results. Further, the Sub-Committee stated the proposed conversion would involve the scrapping of the gas equipment, for which the cost had been incurred. Under these circumstances it did not appear that the proposed capital cost incurred by the substitution should fall upon the Watch Committee, but that the whole cost should be borne by the Electric Supply Department. A further proposal was also submitted by the Department, showing the lighting of nine districts in the city where mains were available, and which showed that the present gas lamps in the whole of the nine schemes cost £1,147, as against £1,038, the total amount for electric fittings. After full consideration of the facts the Sub-Committee resolved that it could not see its way to recommend the Watch Committee to adopt the suggestions of the Electric Supply Department unless that department was prepared to undertake the new capital cost involved in the proposal. This report was adopted by the Watch Committee. Application is to be made to the L.G.B. for sanction to borrow the following sums:—Mains, £57,000; services, £9,000; sub-stations and equipment, £15,000; transformers, £16,500; power-factor rectifiers, £9,000; cooling towers and foundations £11,200. Mains are to be extended in Meadow Lane at an estimated cost of £112, also in South Street Park and Edgedale Road at £231 and £117 respectively.

Shrewsbury.—The T.C. on Monday decided, if necessary, to oppose the Bill of the London and North-Western Railway Co. seeking powers to supply electricity to factories, &c.

South Africa.—Cape Town Suburbs.—A special correspondent at the Cape writes as follows:—"Tenders have recently been called by some of the suburban municipalities for the electric lighting of the streets, and the tender of the Cape Town Corporation has been accepted by the Woodstock, Mowbray, Rondebosch, and Claremont municipalities, and an agreement has also been arrived at between Cape Town Corporation and the Cape Peninsula Lighting Co., for the former to buy out the latter for the sum of £46,500, and current will be supplied on similar terms to Cape Town. The Wynberg municipality, however, accepted the tender of the neighbouring Council of Kalk Bay, which was briefly to supply the municipality of Wynberg with current at 6·6 per unit for street lighting, and 3d. per unit for private consumers. Kalk Bay would require to spend £4,500 on extension of mains, &c., and Wynberg would have to either purchase the existing network from the Cape Peninsula Lighting Co., or erect new network, &c. The tender was approved and advised to be accepted by the Administrator, with the following proviso:—(*a*) That the municipality of Kalk Bay obtain the consent of their ratepayers to the raising of the necessary loan for the prosecution of the work; and (*b*) That the municipality of Wynberg obtain in due course the consent of their ratepayers to the raising of a loan to liquidate the amount to be paid for the purchase of the "overhead equipment" from the Cape Peninsula Electric Lighting Co., Ltd. A public meeting was held, and during discussion it was elicited that current is costing the Kalk Bay Council at present 13·36d. per unit; (This is not a printer's error—it is thirteen point three six.) The ratepayers' necessary consent was not forthcoming, and the scheme was rejected. Subsequently, the Wynberg municipality agreed to find the necessary capital if the Kalk Bay Council's tender still held good. This was confirmed at the last meeting of the Kalk Bay Council. It will be a great pity if the offer of Cape Town to take over the Kalk Bay generating station is not accepted, as with the exception of the Admiralty plant at Simonstown, and the Government railway workshops at Salt River, the whole of the electric lighting in the Cape Peninsula will be from one single generating station owned by Cape Town Corporation."

The services of Mr. A. C. Holtby, M.I.C.E., were requisitioned to verify the calculations of Mr. G. H. Swingler, the Kalk Bay municipal electrical engineer. These calculations Mr. Holtby confirmed in all respects and endorsed Mr. Swingler's report that it would be a profitable undertaking to secure the Wynberg contract on the prices set out in the tender.

The new School of Medicine at Cape Town will be lighted by electricity, the tender of Messrs. Simpson & Scott having been accepted.

Stockport.—The T.C. has instructed the electrical engineer to prepare plans and specifications for the installation of plant to give an A.C. supply for large power consumers. The cost is estimated at £20,000. The question of utilising overhead transmission lines is also to be considered, and the electrical engineer is to visit towns where such lines are used.

The local Tradesmen's Association has sent a protest to the T.C. against the action of the Electricity Committee in hiring out an electrically-driven vacuum cleaner. Such a provision, it was pointed out, was entirely within the realms of the private trade to supply. The Committee has replied that if the Association can assure it that there are three such cleaners in the town to be let on hire, the Committee will discontinue to let out the one purchased by it.

Stretford.—In reply to an application from the Stretford Gas Co. for a supply of energy approximating 25,000 units per annum intermittent load throughout 24 hours, it is to be stated that the supply will be offered at a price of 1½d. per unit, less 10 per cent., for a minimum period of five years, the Council to install the necessary cable at an estimated cost of £100.

Swindon.—The T.C. has agreed to supply electricity to the new ice factory and cold storage being erected in Catherine Street by the Bath Cold Storage and Ice Co., Ltd., at 4d. per unit for lighting and 2d. per unit for power, subject to a minimum annual payment of £20 for three years. The extension of the main will cost £59.

Wakefield.—The T.C. has approved of the City Electrical Engineer's scheme for supplying electricity to Sandal, partly by overhead and partly by underground mains, at an estimated cost of £1,850.

Walsall.—The annual report of the Electricity Committee of the Corporation just issued shows an adverse balance of £184. The Committee points out that this is attributable to exceptional circumstances, largely arising from the heavy expenditure which has had to be borne out of revenue in connection with the extensions and alterations in bringing up to date the existing plant and in installing an alternating-current plant. The Committee states that it is hopeful that as the plant, which is now nearly completed, comes into service, and with continued increased demand for current, a great improvement will be effected, and at the close of this year a substantial profit will be shown. In 1910 a profit of £1,231 was reported.

TRAMWAY and RAILWAY NOTES.

Argentina.—The Dodero electric tramways, in the city of Corrientes, have now commenced running.

Bingley.—The Bingley D.C. has decided to oppose the Bill which the Keighley Corporation is promoting for the purpose, amongst other things, of providing and working a railless vehicle system through Bingley.

Birmingham.—It is reported that the Tramways Committee contemplates augmenting its rolling stock by nearly 100 cars of the latest pattern, at an estimated cost of £700 per car.

Blackpool.—The consideration of a suggested revision of terms under which Blackpool, St. Anne's and Lytham Tramways Co. has running powers over the Corporation's tramway system, has been deferred until March.

Bournemouth.—The Corporation is faced with a serious problem in connection with the tramway undertaking. The borough accountant and the tramway manager have presented reports showing that on the basis of experience in other places, £45,393 should be in hand at March 31st, 1912, as a renewals fund, while the amount actually standing to the credit of the reserve fund is only £7,000.

Continental Notes.—Russia.—A company has lately been formed to construct an electric tramway in the town of Kalisch.

A new section—the Torgoraia-Malorosiskaia—of the new electric tramways in Odessa, has just been completed and put in operation. About 15 miles of the new lines are now open in the city.

Italy.—The projected waterway from Milan to Venice, for the construction of which a Commission is now in session, has, as usual in such cases, important electrical bearings. The project, as outlined by the engineers, contemplates the construction of a canal from Venice to Chioggia through the lagoon; an existing canal, regulated, will then be utilised as far as the River Adige, whence a large new canal will be excavated to the River Po, which will be deepened up to the point where it is joined by the Adda. This river is also to be regulated and made navigable, by means of locks, as far as Pizzighettone, where a third canal is to be constructed. A waterway navigable by vessels of 600 tons will thus be provided. The various waterfalls along the course will be utilised for the generation of electricity for industrial purposes, and electric power to the extent of about 9,000 H.P. will be utilised on these canals.—*L'Ingegneria Ferroviaria.*

Glasgow.—The Sub-Committee on Finance of the T.C. has been asked to inquire and report upon a motion by Councillor Lyon on the whole question of instituting a half-hourly service of cars from 12 midnight to 3 a.m.

Heywood.—At the meeting of the T.C. a suggestion was made that the Council should consider the advisability of running cars to Middleton.

Liverpool.—The Corporation has decided to apply to the L.G.B. for sanction to the borrowing of £8,000 for additional tramway-cars.

Marple.—The U.D.C. has rejected the railless traction scheme submitted by Stockport T.C., owing to the inability of the local authorities to arrange satisfactory terms with each other.

Newcastle-on-Tyne.—The Tramways Committee recommends that free passes be granted to the members of the Council. Alderman Weidner asked the Town Clerk whether the granting of such passes did not come under Sub-sec. 3, Sec. 23, of the Municipal Corporation Act, 1882, which expressly debarred a member having any voice in a matter in which he had a pecuniary interest. Also whether the granting of such passes was likely to be held in the nature of remuneration, and whether it was legal or otherwise? The Town Clerk replied:—(*a*) All members of the Council who use the tramways have a pecuniary interest in the question of the grant of free passes not restricted to use whilst engaged on Council business, and are debarred from voting on the subject by virtue of the section referred to. (*b*) It is probable that the grant of free passes to the members of the City Council without such restriction would be considered by an auditor to be in the nature of remuneration, and illegal. After some discussion, the matter was referred to the Committee again.

Ripponden (near Halifax).—At a meeting of the U.D.C. it was unanimously resolved that the Halifax Corporation be again approached with a view to instituting a tramway service between the Triangle and Ripponden. Some time ago a deputation from the U.D.C. interviewed the Corporation Tramways Committee on the matter, when the chairman of the latter stated that it did not intend to extend the tramways any further into the outlying districts unless it received financial support from the districts concerned. Since then, however, railless cars have come to the front, and it is thought that as these cars can be run at about 6d. per mile and the initial outlay is only about one-seventh of that for the ordinary tramway system, the Corporation may now see its way to accede to the request.

Salford.—The Tramways Committee has decided to make daily return tickets available for the return journey at any time during the day of issue. Hitherto the holder of such a ticket could not make the return journey before 10 a.m.

Uruguay.—A company has been formed to carry out the electrification of the tramways in the city of Paysandu, Uruguay.—*Review of River Plate.*

Walsall.—The net profit of the Corporation tramway undertaking for the past year amounts to £1,575 (after the payment of £3,104, which might have been charged to capital expenditure), and this is to be carried to the reserve fund, which now totals £29,957. The Tramways Committee has informed the Finance Committee that this year it will be able to make a contribution from the profits of the undertaking for the relief of the rates to the amount of £1,000, and that the sum will be paid in two instalments. Seven cars are to be fitted with covered tops, at an estimated cost of £65 for each car, the work to be done by the staff at the depôt, under the superintendence of the manager. The tram workers recently applied for an increase of wages, and the Tramways Committee have now resolved that from March next the maximum rate of pay to drivers be increased to 6¾d., and that of conductors to 5¾d. per hour, and that the pay of the inspectors be advanced to 54s. per week, with a further increase of 1s. per week from March 1st, 1914. In all cases, it is pointed out, the increase will be subject to satisfactory services being given.

TELEGRAPH and TELEPHONE NOTES.

Australia.—On Friday last, Lord Denman, the Governor-General, opened the first Commonwealth wireless telegraph station at Melbourne. The Marconi Co. has since issued a writ against the Government for alleged infringement of its patents.

New Cables.—The new Channel telephone cable was laid last week by the c.s. *Cambria*, between Abbotscliffe and Cape Gris-nez. The cable, which provides two metallic circuits, was made by the Telegraph Construction and Maintenance Co., and is of the continuously-loaded type, the conductor being closely wound with fine iron wire.

A new cable is to be laid between Marseilles and Algiers, with aerial connections with Paris, and with Constantine and Oran in Africa.

Reporting by Telephone.—Special arrangements were made by the Post Office for reporting Mr. Churchill's speech at Belfast last week. The *Westminster Gazette* report was telephoned direct from Belfast to London, and was published the same evening, with the aid of the Exchange Telegraph Co. The Liverpool *Express* utilised the electrophone, 32 transmitters being fixed on the platform, so that Mr. Churchill's own words were heard by the reporters in Liverpool. There are only two telephone circuits in the cable from Stranraer to Belfast, but the Post Office engineers superposed upon them a "phantom" circuit, through which the *Yorkshire Evening Post* received its report in Leeds.

South African Cable Rates.—The Eastern Telegraph Co. will reduce the rate for Press telegrams between Great Britain and Cape Town and Durban from 9d. to 3½d. per word, on March 1st.

Sweden.—The first wireless station in Sweden will shortly be erected by the Marconi Co.; it will have a range of 1,250 miles, and will be situated near Stockholm.

The Telephone Service.—The P.M.G. has published a reply to the complaints to which we referred in our last issue. He points out that the storm in January brought down 3,000 overhead lines in London, and that about 8,000 subscribers have been transferred from the Westminster and Avenue exchanges to new exchanges; in the case of the transfers there were many private exchanges which had to be re-equipped, and the operators had to receive instruction in the new methods of working, and in spite of large additions to the operating staff at the exchanges it was impossible to maintain the services with the usual efficiency. The P.M.G. points out once more that many subscribers overwork their lines with outward calls, preventing inward ones from being received, and this causes a large proportion of the failures to get through. Four large new exchanges are in course of construction in Central London and the West-end. In the meantime there is still a succession of complaints appearing in the daily Press, failure to get through and interruption of line being the most common troubles.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 6th. Service materials for the U.D.C. Electricity Department. See "Official Notices" to-day.

Australia.—Victoria.—March 12th. Testing instruments, for the P.M.G.'s Department, Melbourne. See "Official Notices" January 26th.

March 26th.—Dry cells, for the P.M.G.'s Department, Melbourne. See "Official Notices" to-day.

April 16th.—Magneto table telephones and common battery wall telephones, for the P.M.G.'s Department, Melbourne. See "Official Notices" to-day.

Melbourne.—March 26th. Deputy P.M.G. 1,200 dry cells (Schedule No. 623). Perth.—April 3rd. Deputy P.M.G. Four steel towers 40 ft. high, and two steel towers 55 ft. high (Schedule No. 180). High Commissioner in London for the Commonwealth of Australia, 72, Victoria Street, S.W.—*Board of Trade Journal.*

April 16th.—Deputy P.M.G., Melbourne. 536 magneto telephones and 400 common-battery telephones (Schedule No. 648). A copy of the specification, &c., may be seen at the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Bolton.—February 26th. Stores and materials for a year, for the Corporation Tramways Department. See "Official Notices" February 9th.

Bournemouth.—February 26th. The Education Committee. Tenders for the wiring of the New Science, Art and Technical Schools and Public Library, Lansdowne. Specifications and forms of tender, £2 2s. (returnable), from the Borough Engineer.

Bradford.—February 29th. Emergency excitation battery, and oil-eliminating plant for feed-water purification, for the Corporation. See "Official Notices" to-day.

Bristol.—February 19th. Cables, switchboards, and arc and incandescent lighting at Avonmouth Docks, for the Docks Committee. See "Official Notices" January 26th.

February 19th.—Two electric fire-alarms at Stapleton Workhouse, for the B. of G. Mr. J. J. Simpson, Clerk, St. Peter's Hospital.

February 20th.—Arc lamp carbons, joint and fuse boxes, A.C. meters and D.C. mercury-type ampere-hour meters, for a year, for the Corporation. See "Official Notices" February 9th.

Canada.—The city of Galt is calling for tenders for a synchronous motor, 250 K.V.A., 2,200 volts, 750 R.P.M., to be used on the waterworks.

Cardiff.—February 17th. The Union is inviting tenders for one 30 ft. by 8 ft. Galloway, Lancashire or Yorkshire type boiler and superheater. Specifications and forms of tender from Mr. A. J. Harris, Clerk, Union Offices, Queen's Chambers, Cardiff.

Coventry.—February 22nd. Water-cooling plant of a capacity of 250,000 gallons per hour, for the City Electricity Department. See "Official Notices" February 9th.

Croydon.—February 19th. General stores and goods, for tramways department, for a year, for the T.C. Tramways Manager, Thornton Heath.

March 11th.—Stores for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

Devonport.—March 7th. Switchboard extension and one 1,000-KW. D.C. turbo-generator, for the Corporation. See "Official Notices" to-day.

Dublin.—March 6th. 5,000-volt, 100-KW., three-phase transformer pillars, for the Corporation. See "Official Notices" to-day.

Germany.—The municipal authorities of Weilburg are about to invite tenders for the establishment of a plant to utilise the water-power of the River Lahn in the generation of electrical energy for lighting and power purposes.

The municipal authorities of Neustadt-am-Orle are about to invite tenders for the establishment of a central electric lighting station in the town.

The municipal authorities of Annaberg (Erzgebirge) are about to invite tenders for the supply of a new steam turbine for the central electric lighting station, at an estimated cost of £7,500.

Gloucester.—Stores for a year for the Corporation Light Railways Committee. Mr. L. Johnston, general manager and engineer, Bristol Road.

Heston and Isleworth.—March 5th. Stores for a year, for the U.D.C. Electricity Department. See "Official Notices" to-day.

H.M. Office of Works.—February 21st. Fuse and switchboards, for a year. See "Official Notices" February 9th.

Hornsey.—March 4th. Barometric condenser, pumps, pipework, &c., for the T.C. electricity works. See "Official Notices" to-day.

Hungary.—March 6th. Tenders are being invited by the municipal authorities of Mor (Fejer) for the establishment of a central electric lighting station in the town.

Ilford.—February 27th. Stores for a year, for the U.D.C. electricity works. See "Official Notices" February 9th.

Italy.—February 29th. H.M. Consul at Cagliari (Mr. R. H. Pernis) reports that tenders are invited by the municipal authorities at that place for the establishment of an electric generating station, the construction and working of electric tramways over a distance of 3,280 metres (about two miles), and the illumination of the principal squares and streets of the city by electricity. For further particulars, see this column for February 2nd.

Kirkcaldy.—February 29th. 1,000-KW. steam turbo-generator, with condensing plant and cooling tower, for the Corporation. See "Official Notices" February 9th.

Leeds.—February 21st. 40,000 tons of steam coal, and stores for a year, for the City Electric Lighting Department. See "Official Notices" January 9th.

March 9th.—6,000-KW. turbo-alternator, with exciter, condensing plant, piping, &c., for the Corporation. See "Official Notices" to-day.

London.—BERMONDSEY.—February 19th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" January 26th.

BATTERSEA.—February 20th. Materials and stores for a year, for the B.C. Electricity Department. See "Official Notices" February 9th.

March 5th.—One 1,500-KW. high-pressure steam turbine coupled to two 750-KW. D.C. generators, with surface condensing plant and pipework, and switchgear, for the B.C. See "Official Notices" to-day.

FULHAM.—February 21st. Stores for a year, for the B.C. Electricity Department. See "Official Notices" February 2nd.

HAMMERSMITH.—February 21st. Stores for a year, for the B.C. Electricity Department. See "Official Notices" February 9th.

POPLAR.—February 16th. Extensions to E.H.T. and D.C. switchboards, for the B.C. See "Official Notices" February 2nd.

March 4th.—Telpher coal-handling plant and alterations to existing conveyor at the B.C. electricity works. See "Official Notices" to-day.

ST. PANCRAS.—March 7th. Arc lamp carbons, for the B.C. See "Official Notices" February 9th.

STEPNEY.—The B.C. is shortly to invite tenders for electricity meters at an approximate cost of £2,500.

Manchester.—February 20th. (*a*) Tramcar type ampere-hour meters, and (*b*) general stores for a year, for the Corporation Tramways Department. See "Official Notices" February 2nd.

February 27th.—Eight-ton overhead hand-power travelling crane over auxiliaries, operated from floor-level, for the Corporation Electricity Committee. Mr. S. L. Pearce, chief electrical engineer, Dickinson Street (returnable deposit £1 1s.).

Newport (Mon.).—March 5th. Electric light fittings, for the B. of G. Mr. A. H. Rees, Clerk, Queen's Hill.

New Zealand.—February 21st. 40 miles of hard-drawn vulcanised wire and 13 cwts. of copper binding wire for the Wellington City Council Electric Lighting Department. Messrs. Preece, Cardew & Snell, London.

Oldham.—February 17th. Electric lighting and ventilating of Trinity Wesleyan Chapel, Waterloo Street. Mr. J. Winterbottom, 5, Norbury Street, Oldham.

Tenders are shortly to be invited for superheaters and mechanical stokers at an estimated cost of £1,500.

Pontypridd.—February 21st. Stores and materials for a year, for the U.D.C. Electric Light and Tramways Department. See "Official Notices" February 9th.

Portsmouth.—February 20th. Stores for a year, for the Corporation Tramways Department. See "Official Notices" February 2nd.

Siam.—BANGKOK.—March 15th. Electric power station with a capacity of 3,000 KW. For further particulars, see this column for November 24th.

Walthamstow.—February 23rd. Stores for a year, for the U.D.C. Electricity and Tramways Departments. See "Official Notices" February 2nd.

Warrington.—March 6th. Motors and transformers, for a year, for the Corporation Electricity Department. See "Official Notices" to-day.

Warlingham.—February 26th. Electric light sundries for a year, for the Croydon Borough Mental Hospital, Warlingham. Clerk of the Hospital.

Wrexham.—March 15th. Stores, for the Borough Electricity Department. See "Official Notices" to-day.

CLOSED.

Australia.—SOUTH AUSTRALIA.—The P.M.G. has accepted tenders of the B.I. and Helsby Cables, Ltd., for 12 tons of copper, at £70 per ton, and numerous tapes and binders, porous pots and zincs, &c.; also those of Messrs. G. Wills & Co., for 17 tons of bronze wire; the I.R., G.P. and Telegraph Works Co., for binders, leads, zincs, &c.; the Western Electric Co., for insulators.

Bradford.—Mr. H. Moss has received an order for one 60-H.P. back-geared motor for Messrs. Redfearn & Bedford's new wire-drawing works. Mr. Moss has also received the order for the electric lighting of warehouses and offices, and also for an intercommunication system of telephones for offices, warehouses and mills, at Nortonthorpe, for Messrs. Norton, Scholefield & Co.

Bristol.—The T.C. Docks Committee has accepted the tender of Messrs. Veritys, Ltd., for a main switchboard and connections, for the new Avonmouth Cold Stores.

Burton-on-Trent.—The following tenders have been accepted by the Council:—

British Westinghouse Manfg. Co.—Switchboards, motors, &c., £6,484.
Babcock & Wilcox, Ltd.—Water-tube boiler, &c., £1,892.
Alphons Custodis.—Chimney stack, £445.
E. Green & Sons.—Economisers, £1,346.

Colchester.—The T.C. has accepted the following tenders for the electricity works :—

Crompton & Co., Ltd.—Generator, £264, and £6 for cost of erection.
Lassen & Hjort.—Water-softening plant, £120.
W. H. Allen & Son, Ltd.—Spare armatures for air-pump motors, £63.
Stanford & Co.—Piping for condenser circulating pump and for the K engine exhaust, £50.

Dewsbury.—The Education Committee has accepted the tender of Mr. Foggo, at £125, for the supply and fixing of electric light fittings at Batley Carr Schools.

Glasgow.—The Tramway Committee recommends the following tenders for acceptance :—

Armature coils.—Manchester Armature Repair Co.
Special track work.—Lorain Steel Co. ; Edgar Allen & Co., Ltd.
Travelling crane.—A. Jack & Co.

Hereford.—The T.C. has accepted the tenders of Messrs. Cory & Son, Ltd., for 1,000 tons of Cannop rough small coal to the electricity works, at 10s. 3d. per ton delivered.

London.—BATTERSEA.—The B.C. has decided to renew its contract for the supply of cables, &c., with Callender's Cable and Construction Co., Ltd., for a further period of one year.

River Plate.—The *Review of the River Plate* says that the Minister of War has contracted with Messrs. Siemens-Schuckert for the supply of five portable wireless telegraph outfits, at a cost of $15,312 gold. These are to be supplied to the troops operating in the Chaco.

Rochdale.—The contract for wiring, &c., of the Art Gallery extension for electric lighting has been placed with the Rochdale Electric Co.

Rotherham.—The tender of the British Westinghouse Manufacturing Co., Ltd., at £1,405, has been accepted by the T.C. for a 500-KW. rotary converter, transformer and switchgear plant, for the electricity station ; also the tender of the R.E.T. Construction Co., Ltd., for the supply of three railless cars, at £725 each. The following tenders have also been accepted for supplies of tramway and trolley vehicle materials up to March 31st next :—

J. Russell & Son.—Steel poles.
Naylor Bros.—Bracket arms.
British Insulated and Helsby Cables, Ltd.—Trolley wire.

Sheffield.—The following tenders have been accepted by the T.C. :—

Guest, Keen & Nettlefolds, Ltd.—40 tons of wrought-iron tramway tie-bars, £420.
Cecil Walton.—Dismantling existing coal and ash conveyors at Kelham Island power station, and erecting in lieu thereof new coal and ash elevators and conveyors, £2,950.
A. Reyrolle & Co., Ltd.—Extra-high-tension switchboard at Neepsend power station, £6,447.

Stoke-on-Trent.—The Corporation has placed an order for "Bennis" stokers and self-cleaning compressed-air furnaces, for the electricity station, Hanley, with Messrs. Ed. Bennis and Co., Ltd.

Watford.—The U.D.C. has accepted the tenders of the British Westinghouse Co. and Messrs. Ferranti, Ltd., for 12 months' supply of meters on their schedules of prices.

Wimbledon.—The T.C. Watch Committee has decided to accept the tender of the Gamewell Fire Alarm and Police Telegraph Co., at £1,098, to install their fire-alarm system in the borough ; and instructions have been given the Town Clerk to ascertain from the Post Office London Telephone Department the terms upon which the Department would grant to the Council the use of cables (joint or separate) for the system and maintain it.

THE ELECTRICAL ENGINEERS

(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders are issued :—

Monday, February 19th.—"A" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Tuesday, February 20th.—"B" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Thursday, February 22nd.—"C" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

Friday, February 23rd.—"D" Company. Technical work, 7 to 8 p.m. Lecture on "Military Telephones," 8 to 9 p.m. Technical work, 9 to 10 p.m.

A special mobilization week-end run will take place at Fort Coalhouse in conjunction with the R.G.A. This run will be continuous until dawn on 25th. The party for this run will parade at Fenchurch Street Station (L.T. and S. Railway) at 3.10 p.m. for the 3.25 p.m train, sharp. Dress : Service dress, putties, greatcoats, belts and haversacks ; no arms will be taken.

Saturday, February 24th.—The second relief will parade at the same time and place for the run.

(Signed) P. H. CAMPBELL, Capt. and Adjt.,
For Officer commanding L.E.E.

FORTHCOMING EVENTS.

Electrical Engineers' Ball.—To-night, Hotel Cecil.

Institution of Mechanical Engineers.—Friday, February 16th. At 8 p.m. Annual general meeting.

Institution of Electrical Engineers (Yorkshire Local Section).—Friday, February 16th. Annual dinner.

Institution of Electrical Engineers (Scottish Students' Section).—Friday, February 16th. At 8 p.m. At the Technical College, Glasgow. Paper on "The Application of Electricity to Paper-Making," by Mr. N. M'Phee.

Junior Institution of Engineers.—Saturday, February 17th. At 6.30 for 7 p.m. At the Hotel Cecil, London, W.C. Annual dinner.

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, February 19th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "Automatic Isolation of Faults on High-Tension A.C. Systems," by Mr. J. G. Craven.

Illuminating Engineering Society.—Tuesday, February 20th. At the Royal Society of Arts, John Street, Adelphi, London. Discussion on "Shop Lighting," to be opened by Messrs N. W. Prangnell and A. E. Broadberry.

Institution of Electrical Engineers (London).—Thursday, February 22nd. At 8 p.m. Paper on "The Supply and Transmission of Power in Self-contained Road Vehicles and Locomotives," by Messrs. J. C. Macfarlane and H. Burge.

Institution of Electrical Engineers (Manchester Local Section).—Friday, February 23rd. Annual dinner.

Royal Institution.—Friday, February 23rd. At 9 p.m. Discourse on "The Gyrostatic Compass and Practical Applications of Gyrostats," by Mr. G. K. B. Elphinstone.
Saturday, February 24th.—At 3 p.m. Lecture on "Molecular Physics," by Prof. Sir J. J. Thomson. (Lecture I.)

Physical Society.—Friday, February 23rd. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "A Method of Accurate Comparison of Quantities of Radium," by Prof. E. Rutherford and Mr. Chadwick ; "The Absorption of the γ-rays by Gases," by Mr. Chadwick ; and "On Wave-form Sifters for Alternating Currents," by Mr. A. Campbell.

NOTES.

The General Electric Co.'s Annual Dinner.—On Saturday last, the twenty-first annual dinner of the General Electric Co., Ltd., was held at the Trocadero ; the chairman of the company (Mr. H. Hirst) presided, and covers were laid for over 500 guests and members of the staff, who foregathered from all parts of the country. Among the guests were many well-known public men, representatives of the Colonies, of law, science and industry, and many consulting engineers and central station engineers.

After the customary loyal toasts, the chairman proposed "Engineering Science and Industry." He expressed his sense of the responsibility imposed upon him by the loss of the late Mr. G. Byng, and eulogised the great business capacity of the founder of the company, who for 13 years had fought against disease until the end came last year. During that time it had devolved upon the speaker to carry on the business of the company, and to establish various new works and branches, both at home and abroad ; if he had succeeded, his success was due to the support always received from Mr. Byng, who at all times, ill or well, kept in close touch with affairs. He regretted the absence, through illness, of Mr. Ferranti, who was to have responded to the toast, and recalled the days when the business was established, the only central station then existing being that run by Mr. Ferranti at Grosvenor Gallery. The development of that great company from small beginnings would not have been possible without the aid of a most loyal staff, most of the important positions on which, he was proud to say, were filled by men who had started with the company at 10s. a week, and were now receiving from £500 to £2,000. At times they had been hampered by the difficulty of finding men capable of filling high administrative posts, especially those abroad ; the staff of necessity had to specialise, and thus lost the broadness of mind required in positions of this kind. Why could they not induce men of superior ability and education to enter business instead of the learned professions ? They only tried business when all other resources failed. He was willing to pay premiums to University men who would allow themselves to be trained for high positions, which would be well remunerated. The predominant question in the minds of statesmen was the fight for the world's markets, which called for leaders of the highest ability. Such men were drawn from the Universities of Oxford and Cambridge, where they received exactly the training that was required in modern business. Trade was no longer a matter of huckstering ; it had been transformed by modern methods, and "Captains of industry" must be men of many qualifications—readers of character, capable of leading men, equipped with knowledge of modern arts and sciences. The company had sent 50 men abroad during the last few years—men who had been trained by the company, but who would have been all the better for a broader education. If other nations attracted the best brains to commerce, so must we. To-day the greatness of the country depended upon the leaders of industry ; the Universities ought to supply such men, and to imbue them with a sense of the dignity of their calling.

Prof. Perry, responding to the toast, referred to the wonderful progress that had been made by the company, and was glad to learn that so many had risen to eminence in the business with a humble start. But the poor office boy, he said, had the very worst kind of education for his calling ; he was taught everything that was unessential, but the essential things were neglected. He ought to be able to write a letter in English, to do mensuration, and to know something about physical science. Above all, he ought to be

fond of reading — then he would educate himself as long as he lived. The fault lay with the primary schools, whose deficiencies had to be made good by the evening-class teachers, wasting years that should have been more profitably employed. He believed that the average man was just as clever as the man who was reputed clever, but that our methods of teaching were not adapted to the average man. Fortunately other countries were even worse than this; the safety of the English boy lay in going in for sports so that he did not become dulled, but remained an individual, not a machine. Reform in educational methods was urgently needed. Sir Edward H. Holden also responded, and warmly defended the boy from the Council school, who, if encouraged to study, could beat the University man. The company's staff consisted of Council school boys; he thought it would not have attained the same degree of success if it had depended upon University men. Mr. Walter, K.C., said the question raised by Mr. Hirst was one of paramount importance to the country. The fault lay in the fact that teachers were not properly trained for their profession, and were poorly paid, so that they could not be expected to be enthusiastic in their work. The scholarship system was another grave mistake. He agreed with the Chairman as to the necessity of keeping business methods abreast of modern scientific progress.

Mr. E. G. Byng, vice-chairman of the company, proposed "Parliaments of Empire"; now for the first time representing his father's name and family, he acknowledged the burden of responsibility which rested upon his shoulders, and asked the friends of his father and the G.E. Co. to be lenient to his faults. Mr. Hirst, as chairman, was the right man in the right place, and he assured him, on behalf of himself and his brothers, that it was their determination to work under him with loyalty. He hoped that the House of Lords, a house stabbed to the heart, would yet recover. The House of Commons had passed many excellent measures—the Insurance Act, Employers' Liability, Workmen's Compensation, &c.; in fact, it had protected everything except industry! Perhaps its turn would come soon. (It would be unfilial, he said, not to mention Protection once). Referring to the 42 Parliaments of Empire, he pointed out that Sir J. Taverner (Agent-General for Victoria) was present, who was the first man to provide a permanent home in London for an Overseas Dominion; that would soon be followed by the great Australian building in Aldwych. In responding, Sir W. Bull said he hoped Mr. Byng would eventually represent the G.E. Co. in Parliament, and that one day there would be a Pan-Britannic Parliament sitting in Westminster Hall to consider matters of Imperial interest. Sir J. Taverner agreed with Sir W. Bull, holding that the British Parliament was clogged with work, to the detriment of the wellfare of the Empire. The time was ripe for the establishment of an Imperial Parliament with Empire representation.

Mr. M. J. Railing proposed "Success to Imperial Trade," remarking that modern methods of communication had made the world one great market; had they always risen to the opportunities offered to them? Increased output meant cheaper cost of production and better competition, and if they made use of their opportunities they had as great advantages as any country in the world. He looked forward to the establishment of one Imperial patent law, one company law, one system of weights and measures, and one code of standards throughout the Empire. Sir George H. Reid (High Commissioner of the Commonwealth Government) responded, and expressed his sympathy with the average boy, having been one himself. The children of England, he said, had never had half a chance; they would have to be more efficient than their ancestors, for modern industry was a kind of warfare. Every man could do something for the Empire now, without waiting for an Imperial Parliament; let everyone give a real preference to his own country —no Act of Parliament was needed for that. Let them set an Imperial brand on the manufactures of the Empire—"Made in the British Empire," not "Made in Germany." Lieut.-General Sir J. Bevan Edwards, also responding, said the Royal Colonial Institute had formed a special committee to deal with Imperial trade, and Mr. Ellis T. Powell said that the suggestion that a chair of Empire Trade should be founded at London University had been favourably received by the authorities.

Lastly, Mr. Faithfull Begg proposed the health of the chairman, to whom, he said, the success of the company was due in a pre-eminent degree; his energy ensured the success of everything he tackled. The toast was honoured with great enthusiasm, and the Chairman, after expressing his acknowledgments, toasted "The Staff." After the conclusion of the speeches, a concert took place, an excellent programme having been arranged, and the gathering did not break up until a late hour.

Every guest received a copy of the *Magnet Magazine*, the new journal of the General Electric Co., Ltd., to which we refer under "Book Notices."

Dublin Electrical Contractors' Association Dinner.

—On Saturday the members of this Association entertained a numerous company at dinner in the Hibernian Hotel. The President, Mr. T. E. Brunker, occupied the chair. The loyal toast was accorded musical honours. The president proposed the "Institution of Electrical Engineers," and Messrs. Pilditch and Tatlow responded. Mr. Tatlow spoke of the close connection between electrical contractors and the Institution, and of the attention the Institution had given to wiring regulations, which varied with different insurance companies.

The president proposed "The Institution of Civil Engineers, the Royal Institute of Architects, and the Engineering and Scientific Association." Mr. G. M. Ross responded for the Institution of Civil Engineers, Messrs. Ashworth and Own for the Royal Institute of Architects, and Messrs. Miller and Porte for the Engineering and Scientific Association.

Being constantly in touch with electrical contractors, Mr. Porte was able to speak of their high personal qualities. He proposed "The Health of the President" (Mr. Brunker). The president in returning thanks said that the object of the Association was to see that the best possible electrical work was done for the public. The members wished to do away with the "jerry contractor." They also wished the workmen employed to receive adequate wages. They were anxious for genuine, respectable electrical contractors to become members of their Association. In his opinion it was one worthy of the support of all central station engineers, and of all consulting engineers.

Mr. Richey proposed "The Health of the Honorary Secretary to the Association" (Mr. C. Howard Egan). Mr. Egan, in his reply, spoke of contractors who carried out work (often very well) at ridiculously low prices without any profit, and who consequently "died out" in a few years. He thought it should be impressed upon all present that the members of the Association were combined for the good of the public. He hoped that any outstanding contractors of note would join the Association.

The President proposed "Our Guests." Mr. Ruddle responded to the toast. He emphasised the importance of sound electrical work, and the danger arising from imperfection.

Capt. Purcell, Chief of the Dublin Fire Brigade, said he was directly interested in the operations of the Association. Speaking from experience—largely gained from visits to America—he said that very often disastrous fires were caused by electricity. He had seen methods for distributing electricity in America which would shock the members of the Association. There was certainly no regard for human life in America. Members of his own profession had on many occasions lost their lives at fires for the simple reason that in many cities in America high-tension wires were run overhead in bunches mingled with other wires. Moreover, when artisans were dealing with telephone or telegraph wires, they sometimes came in contact with these high-tension wires, and were killed in full view of the people in the street below. That was all due to the desire for "rush" and cheapness. He was glad to say that the Board of Trade and other people concerned in this country had laid down rules which had in a great measure prevented such accidents, the high-tension wires being laid underground. Dublin was singularly free from such accidents, and from fires due to electrical causes, and he had always attributed this to the careful supervision of the Corporation and to their not giving current to any establishment until the wiring and fittings had been thoroughly tested. He had also predicted that as the use of electricity became more common, people would grow foolhardy and careless, and as a consequence the proprietors of establishments would engage handy men to make extensions to their electrical systems and to put an additional load upon a circuit that it was not intended to bear. The result was that the fuses would possibly blow, and then the handy men would procure the nearest piece of ordinary wire and make a connection—and the fire brigade would come in last. He had always held that electric lighting was the safest of all means of lighting when properly installed, but that it was the most dangerous of all means of lighting when improperly installed. When speaking to proprietors of establishments upon the matter his advice to them had always been: "First get a proper specification for the work from a qualified consulting engineer; next get a reliable contractor, pay a proper price; don't take a cheap contractor. Take a man you can rely upon to do thoroughly honest work. If the work is done in a cheap fashion you have wires that are not capable of carrying the current, and you never know where you are. You have a terrible danger lurking within your house." He was sorry to say that his prediction as to carelessness in the use of electricity was to some extent coming true. During the past year in Dublin there had been eight fires which had been proved beyond all doubt to be due to electrical defects. In one case, a man admitted it was owing to the fact that some friends had pressed him to give the work to some poor fellow who would do it cheaply. Of course, the insurance company paid, but, all the same, the man's business suffered. It was for such reasons as these that he (Captain Purcell) wished genuine electrical contractors to get the work.

Institution and Lecture Notes. — Institution of Mechanical Engineers.

—The annual report of the Council, to be submitted to the members to-day, states that the total membership at December 31st, 1911, was 5,828, an increase of 128. The revenue for the year was £15,922, and the expenditure £12,295, leaving a balance of £3,123 (with £504 carried to capital account). The total assets were £108,896, and after deducting debentures, the capital was £60,632. Extensions of the Institution building are in progress. A benevolent fund is being established under the Companies' Consolidation Act as a company limited by guarantee, with a nucleus of 1,000 £1 shares in Messrs. W. H. Allen, Son and Co., Ltd., presented for the purpose by Mr. W. H. Allen. The Council has had under consideration the question of holding entrance examinations for the younger applicants for admission, and has decided in favour of this course, subject to the approval of the members; the examinations of certain educational authorities being accepted as equivalent to, and exempting from, the Institution examination. The next summer meeting will be held in Belfast.

Institution of Electrical Engineers (London Students). —The annual dinner of the Students' Section will be held at the Trocadero on Saturday, March 16th.

Institution of Electrical Engineers.—Prior to the holding of the last ordinary meeting on February 8th, the President

announced that with a view to bringing the Provincial members into closer touch with headquarters, the Council had decided to hold summer meetings at the local centres, and that the first will be held this year at Glasgow, commencing on June 12th and terminating on June 14th. Arrangements are being made by which in addition to the reading of papers, visits will be paid to works, &c. It was also announced that Mr. Spagnoletti had been elected an honorary member of the Institution.

Northampton Institute Engineering Society.—Mr. W. Gilbert read a paper on "Radiotelegraphic Detectors" before the above Society on February 9th, which was much appreciated.

At a meeting held in Edinburgh, on February 3rd, of the Scottish branches of the National Association of Colliery Managers and the Association of Mining Electrical Engineers, Mr. Robert Nelson, H.M. Electrical Inspector of Mines, replied at considerable length to the criticisms passed on his paper, "Electricity in Mines; the Avoidance of Accidents." He said that his idea in the paper had been to show that safety in electrical apparatus for use in mining was to be secured, first, by protectively surrounding all live parts with insulating material, and, secondly, by protecting that insulating material from mechanical damage by means of an earthed metallic outer covering. There was apparently universal agreement amongst the critics so far as the first contention was concerned, and the real difference of opinion seemed to be as regards his second argument. Earthing was only a safeguard when insulation had failed. Mr. G. L. Kerr, of Glasgow, had made a statement which was palpably wrong. He had asserted that there had been a big increase in the number of armoured cables, owing to the pressure of the Home Office, and that, in consequence of that pressure, a great many managers had substituted armoured for unarmoured cables. He would like to ask Mr. Kerr when, and in what way, the pressure was exercised, and whether any person had substituted armoured for unarmoured cables unconvinced of the superiority of the former. Mr. Kerr had also said that the result of these ill-considered regulations, if passed into law, would be to prohibit the use of electricity in a very large number of mines in Great Britain, and they would undoubtedly bear very hardly on many colliery undertakings; so far as he was aware, however, no person had ventured upon a detailed criticism of the regulations. Mr. G. L. Kerr, in a brief explanatory statement, said he adhered to his opinion that the Home Office had been forcing the use of armoured cables into collieries, and, personally, he knew of cases where armoured cables had been put in through the pressure of mines inspectors and much against the wishes of the management. He was glad to be able to congratulate Mr. Nelson and the Home Office on the regulations as now framed for adoption.

A paper was read by Mr. C. A. Carlow, Fife Coal Co., on "Lessons to be Learned from the Electrical Mining Accidents in Scotland in 1910." Mr. Carlow said that they had in Fife alone at least 1,000 motors running in connection with collieries. The Fife Coal Co. had 65 coal-cutting machines, cutting 660,000 tons in the year.

Institution of Electrical Engineers (Yorkshire Local Section).—The meeting announced to be held at Leeds University, on the 14th inst., was unavoidably postponed.

Society of Engineers.—The Council may award in 1912 two premiums, to the value of £8 8s. and £4 4s., for approved essays on the subject of "How to Improve the Status of Engineers and Engineering, with special reference to Consulting Engineers." The competition is open to all, but application for detailed particulars should be made to the Secretary before entering. The last date for receiving essays is May 31st, 1912.

Junior Institution of Engineers.—A handy little booklet has just been issued by this progressive Institution, dealing with "Its Origin and Aims," and makes interesting reading. It may be obtained free from the Secretary, 39, Victoria Street, Westminster, London, S.W.

Metropolitan Association of Electric Tramways Managers.—A meeting of this Association was held at the Municipal and County Club, Whitehall Court, S.W., on Friday, 9th inst., when the following were present: Messrs. A. H. Stanley, managing director, London Electric Railways and London United Tramways, chairman of the Association; H. E. Blain, West Ham; H. L. Howard, Barking; W. E. Hammond, Metropolitan Electric; A. V. Mason, South Metropolitan; Z. A. Knapp, London United; and T. B. Goodyer, Croydon, hon. secretary. Letters of regret at their inability to be present were received from Messrs. A. Coveney (Erith), W. Murray (Walthamstow), W. C. Ullmann (East Ham), F. Scofield (Leyton), and S. Dudman (Dartford).

The Koss Water-Railway.—Experiments have recently been made on the Dortmund-Ems Canal, in the presence of representatives of the German Government and Industry, with a new towing scheme which, it is claimed, is destined to revolutionise the service on inland waterways. Its inventor, Baurat Koss, a member of the Canal Administration, considers that he has succeeded not only in eliminating all the drawbacks of towing in its present form, but in greatly increasing its efficiency. The water-railway is a series of barges with wheels, compelled to move on a rail. But while the driving wheels of a railway train are intended to propel the train by the friction due to its weight and the resulting adhesion on the rails, the water-railway, in the absence of adhesive friction, requires artificial friction. This is produced by causing the wheels fixed to the bottom of the tug-boat to lift to about ½ to 1 m. height an iron rail lying at the bottom of the canal. The moorings of this rail are such as to allow of its being readily lifted beyond the surface of the water (*e.g.*, for the sake of inspection and repair) without loosening any joint. On the other hand, they prevent any objectionable displacement in a horizontal direction. On account of the stable equilibrium of the tug-boat, the water-railway, unlike ordinary land railways, obviously requires only a single rail supporting the four wheels fixed below the bottom of the tug-boat. These wheels, actuated from the latter, may be said to draw the rail along between them, like the rolls of a rolling mill. In fact, the rail, as it were, is threaded into the wheels, and on the passage of the tug-boat, performs an undulating motion, its adhesion to the wheels setting the train of barges in motion, like an ordinary railway train propelled by its driving wheels. This propulsion along a substantial rail (in lieu of a screw propeller) is said to utilise three-quarters of the energy expended.

The water-railway thus is based on an entirely novel principle, viz., the lifting of a rail. Like so many other pioneers, the inventor had at first to contend against much prejudice. Nobody was inclined to believe that heavy iron rails could be lifted to a height of ½ to 1 metre by comparatively modest forces, and comprehensive preliminary tests were required to show the correctness of these views. A heavy iron rail of square cross-section, 80 metres in length, and 28 kg. in weight per metre, was found to be lifted by a quite moderate force (250-450 kg.) to heights variable between ½ and 2 metres. Further tests on rails of the smallest standard profile, weighing 6 kg. per metre, likewise gave encouraging results, bearing out in full Mr. Koss's theory.

The experimental tug-boat is arranged for electric propulsion, and derives its motive power provisionally through a cable, from the power boat of the canal equipped with a dynamo, which forms part of the train. However, the service eventually may be done by means of a trolley system, similar to that of an electric railway. In fact, part of the experimental section of the canal was fitted with a trolley wire stretched at a convenient height above its surface. The principle itself is of course quite independent of any special form of motive power; in fact, the tug-boat could as easily be driven by a Diesel motor or by any other means. Each of the barges is fitted with a brake, allowing the train to be quickly stopped by the aid of the rail, thus avoiding any collision between the barges.

The driving power is transmitted from the motor shaft, through pinions, to four vertical wheel axles, which, below the bottom of the tug-boat, are protected by an iron casing. The rail, as above stated, passes through the four wheels embracing it; the towing cable is likewise fixed to the iron casing. A hand-wheel allows the rail to be dropped clear of the tug-boat; after having then been detached from the train, the boat, fitted with a small screw propeller, may proceed without the aid of the rail, to any other canal section.

For Sale.—Messrs. Barker & Co. (Coachbuilders), Ltd., have for sale a complete generating plant suitable for works or country mansion. The Birmingham City Tramways Committee have for disposal the whole of the machinery and plant at the Bournbrook generating station. The goodwill and business of the Langdon-Davies Motor Co., Ltd., are being offered for sale as a going concern. The Oldham Co-operative Society, Ltd., have certain boilers, steam and gas engines and dynamos, &c., for sale. See our advertisement pages to-day.

Appointments Vacant.—The consulting engineers to the Bombay Hydro-Electric Power Transmission scheme (Messrs. A. Dickinson & Co., of Birmingham) are advertising for an engineer to superintend the construction and erection of a three-phase 100,000-volt transmission line 45 miles long; two divisional superintending engineers; one divisional superintending engineer with special experience in the erection of towers over navigable tidal creek and transmission towers 160 ft. high, creek 9,000 ft. wide: also three erectors.

A Professor of Electrical Engineering is wanted for the Manchester Municipal School of Technology (£600); electrical engineer for the Willesden U.D.C. (£300). See our advertisement pages to-day.

The I.M.E.A. Convention, 1912.—A preliminary programme of this Convention, which is to be held at Harrogate on June 18th, 19th, 20th and 21st next, has been issued.

Following the official proceedings and presidential address on the opening day (Tuesday), a discussion will be initiated by Mr. Frank Ayton (Ipswich) on "Means for securing reliability and maintaining continuity of electricity supply," and after luncheon Mr. F. M. Long (Norwich) will open a discussion on "A cooking load from the supply station point of view." In the evening a reception and concert will be held by the Mayor and Mayoress of Harrogate.

On the second day the party is to visit Leeds, where an official welcome will await it; and subsequently papers will be read by Mr. S. L. Pearce (Manchester) on "Limitations of Profit from Municipal Trading," and by Mr. R. A. Chattock (Birmingham) on "Organisation in Electric Supply Undertakings." The afternoon is to be devoted to visits to works, and in the evening the annual dinner will be held at headquarters—the Majestic Hotel, Harrogate.

The third day commences with a journey to Middlesbrough, where Mr. S. J. Watson (Bury) will open a discussion on "Automatic Pressure Regulation," and visits to local works are projected for the afternoon. An alternative visit to York is also being arranged on this day chiefly for the ladies.

The morning of the last day (Friday) is to be devoted to the annual general meeting, while the afternoon is given up to an excursion to Ripon, Studley Royal and Fountains Abbey.

This programme is subject to alteration except as to date; ladies, it may be noted, are now invited to the annual dinner.

It will be noticed by our readers that only a week end intervenes between the summer meeting of the Institution of Electrical Engineers to be held at Glasgow on June 12th-14th inclusive, and the M.E.A. Convention.

ELECTRIC POWER IN SOUTH-EAST KENT.

It will be within the knowledge of the majority of our readers that south-eastern Kent has lately sprung into industrial prominence by reason of the vigorous development on a large scale of the extensive coal measures which have been proved to exist in that locality.

The Tilmanstone Power House, with Adjacent Colliery Winding-Engine House.

The presence of coal beneath the Kentish chalk has, of course, been surmised for many years, but no particular importance was attached to this coalfield until after 1906. Since that year numerous syndicates have set to work to prove the coal area, and in the country lying, roughly, between Dover, Sandwich and Canterbury, it is on record that as a result of 12 borings, 96 seams of coal have been proved with an aggregate vertical thickness of 320 ft.; this corresponds to from 30 ft. to 60 ft. of coal per pit.

Plan of the South-East Kent Power Co.'s Area, showing the Positions of the Various Collieries and Borings and the Tilmanstone Power Station.

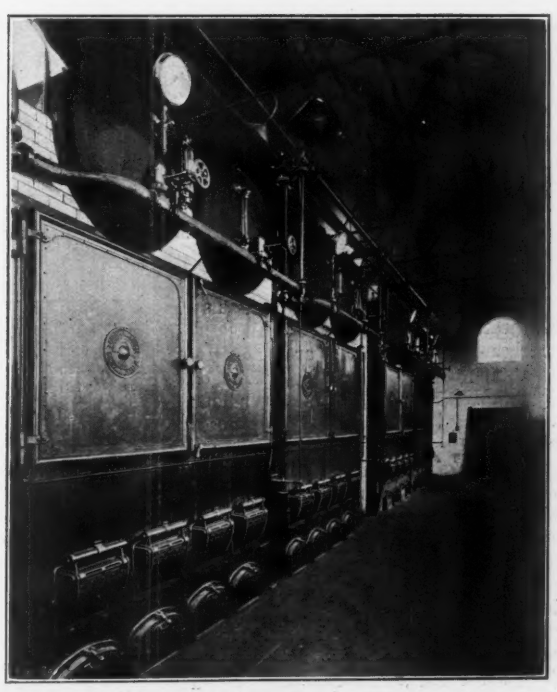
The importance of this Kentish coal find, both as to quantity and quality, is not yet appreciated even in London, which at present pays so dearly for its fuel requirements. But it is not our purpose to refer at length to the question of the coal, except in so far as it has led to the introduction of electric power in south-east Kent.

In view of the great importance which attaches to electrical methods of working in connection with modern mining operations, one of the first essentials in a new coalfield is a supply of electrical power available for preliminary operations.

This the East Kent Colliery Co. arranged to provide, and for this purpose erected an up-to-date power station at their Tilmanstone Colliery, where sinking operations have so far advanced that two shafts are down some 1,200 ft. and a third one 900 ft., while a very fine Markham winding engine has been installed.

On the transfer recently of the Kent Electric Power Co.'s electric supply powers for the area embraced between the River Stour on the north, as far as Canterbury, and due south from that city to Hythe on the coast, to the South-East Kent Electric Power Co.—a concern which is closely allied with the various colliery undertakings—the latter took over the Tilmanstone power station to form the nucleus of the much larger undertaking which will obviously be required to supply the electrical needs of the seven or eight collieries now projected in this area, and possibly of the coast towns of Folkestone, Dover, Walmer, Deal and Sandwich, which are also included. Mr. G. F. Metzger, whose connection with municipal electrical work, as chief engineer at Bath and later at Manchester, will be remembered by our readers, designed and supervised the whole of the work in connection with the power station and colliery at Tilmanstone, as consulting engineer to the East Kent Colliery Co., and is now engaged on the much larger project of the South-East Kent Electric Power Co., of which he has been appointed chief engineer.

Some idea of the ultimate scope of the S.E. Kent Co.'s operations may be gathered from the fact that designs are being prepared, under Mr. Metzger's supervision, for a larger power station, to be situated at either Sandwich or Snowdown (the site of one of the allied company's collieries), and to be capable of meeting demands estimated at upwards of 30,000 KW.



Interior of the Boiler House.

The power house has been substantially erected in red brick, and contains 1,400 KW. of modern turbine plant, boilers, &c., supplying three-phase current at 3,000 volts and 50 cycles, for sinking and pumping operations in one of the adjacent shafts.

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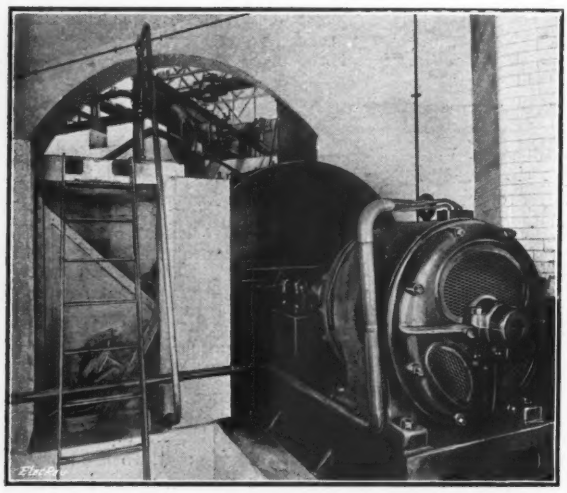


Electrically-Driven Induced Draught Plant.

It was constructed in record time, as the first sod was only cut on February 10th, 1911, and current was available five months afterwards.

Coal is brought direct to the power-house bunkers over the East Kent Light Railway, a line which will eventually connect to all the important collieries in the neighbourhood, and siding space has been arranged to accommodate ten trucks of coal.

The boiler house contains four Babcock & Wilcox land-type boilers in pairs; each boiler has 4,020 sq. ft. of heating surface, and is constructed for a working pressure of 200 lb. per sq. in., the steam being also superheated 150° by means of integral superheaters. The boilers are arranged for hand firing, and each is capable of evaporating 15,000 lb. of water per hour under normal conditions. The gases pass from the boilers through a Green economiser of 400 tubes arranged in two groups, with a small steam engine for actuating the scraper gear, and are drawn through one of two "Sirocco" induced-draught fans discharging through a 70 ft. × 5 ft. 6 in. diameter steel chimney.

The fans, which are used alternatively, are driven, the one by an Alley and McLellan engine, and the other by a 440-volt three-phase Westinghouse motor.

It may be well to mention here that Messrs. Babcock & Wilcox, in addition to supplying the boilers, &c., supplied the whole of the piping in both the boiler and turbine houses.

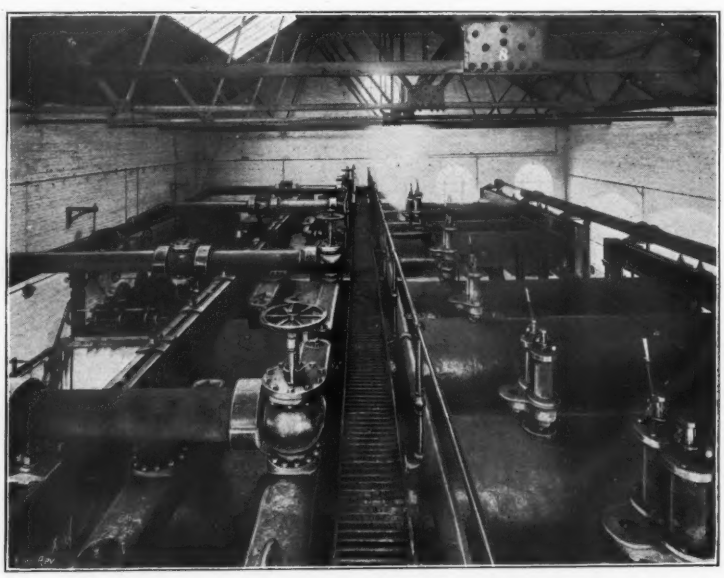
One of our views shows the steam pipe arrangement in the boiler house, which consists of 7-in. boiler branches leading to a 10-in. header divided by valves into two sections, each of which supplies one turbine through a branch leading down to a steam separator beneath the turbine, the stop valve of which is supplied through a short rising pipe.

An auxiliary main supplies the fan and economiser engines and feed pumps, and the latter have an alternative connection to the main steam pipe.

Two Weir feed pumps, of a type used throughout the colliery for boiler feeding, are installed in the boiler house; each has a capacity of 5,100 gallons per hour, drawing water from the hot well and feeding alternatively through the economiser—the usual hot feed—or through a cold feed main direct, in case of repairs to the economiser or hot range.

The steam and feed mains are of solid drawn piping with mild steel flanges riveted or screwed and expanded on. The firm's contract also included riveted steel atmospheric exhaust and cast-iron condensing water piping.

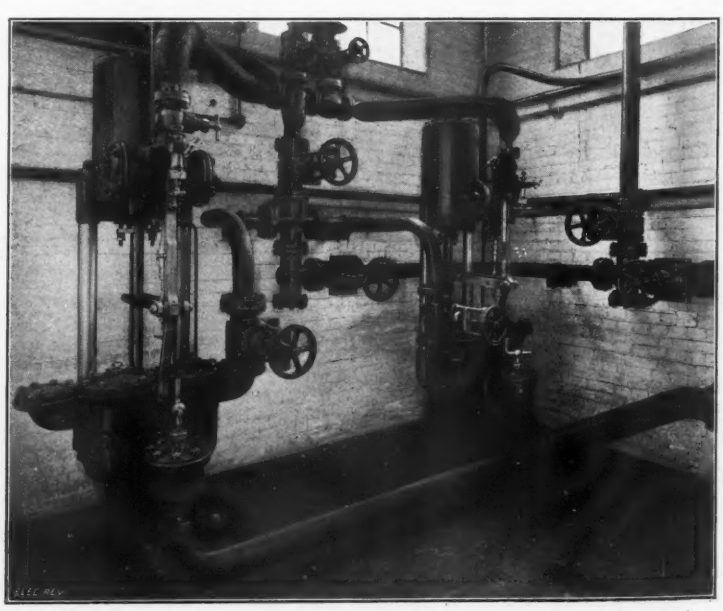
The whole of the water for condensing and boiler feeding comes from the adjoining pit, and as it is charged with galt and fine grit, it has been necessary to install a filtering plant for the water required for boiler feed make-up, bearing circulation, &c.



View over the Boilers, showing Steam Pipe Arrangement.

The pit water gravitates from an adjoining reservoir through a Rake-type pressure filter, of Messrs. Mather and Platt's make, the filtered water being pumped up to an elevated storage tank situated 30 ft. above the filter base.

Alumino-ferric solution is added to the water entering the filter in order to coagulate the finely divided matter in suspension; the unfiltered water enters at the top of the filter—a riveted steel tank—and percolates through filtering material



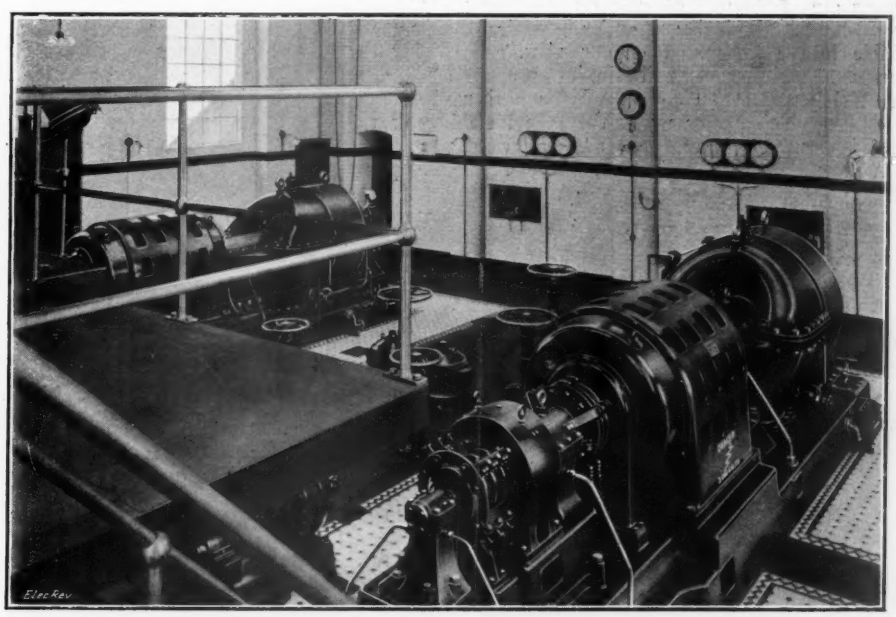
Weir Boiler Feed Pumps.

consisting of graded quartz crystals to a collecting chamber underneath, from which it passes to a 6-B.H.P. motor-driven turbine pump for delivery to the overhead tank. This filter, which has been found to be most effective in practice, is cleansed by simply passing filtered water through in the reverse direction.

Turning to the engine-room plant, the whole of which, we may note in passing, has been supplied by the British Westinghouse Co., there are installed two turbo-alternators, which were specified to give 1,000 KW. when running non-condensing and 1,200 KW. when working condensing.

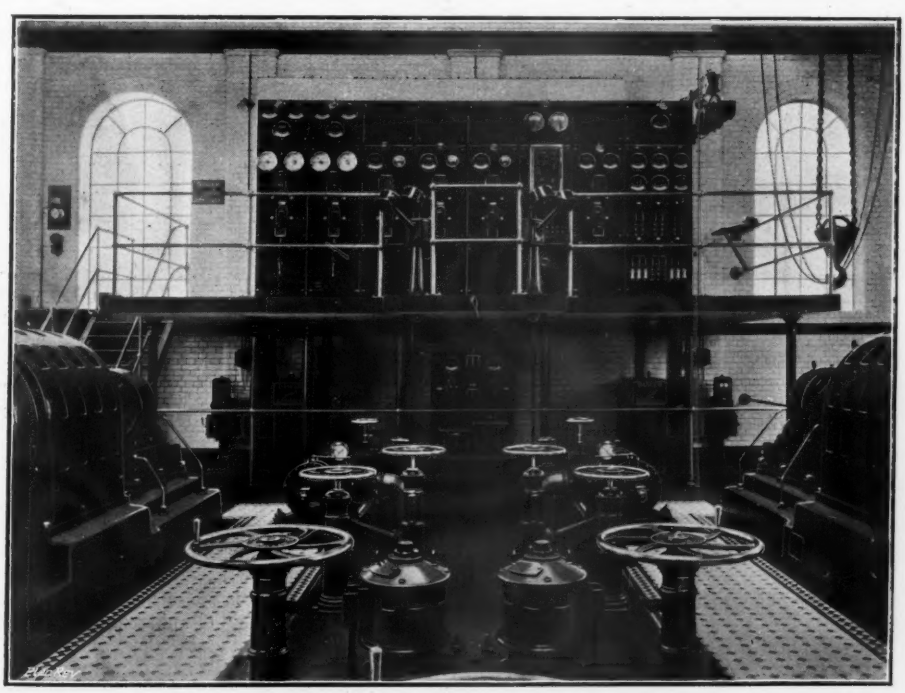
The turbines are of the well-known Westinghouse impulse type, and are supplied with steam at 200 lb. per sq. in. pressure, and 150° superheat. The turbines normally operate condensing, but hand-operated nozzles are provided whereby, in case it should be necessary to shut down the condensing plant for any reason, extra steam may be admitted to the turbines to enable them to carry their full load non-condensing. These same nozzles can also be used to negotiate a 25 per cent. overload under normal condensing conditions. The alternators generate three-phase current at 3,300 volts and 50 cycles, the speed being 3,000 R.P.M. These machines are of the revolving field type, and are of massive construction. One of our views, taken from the switchboard gallery, shows the turbo-sets very clearly. The exciters are direct driven. A view on page 264 shows the steam end of a turbine, seen at the far end of the turbine room.

The two condensers are located directly under the turbines,



Westinghouse Turbine Plant in the Engine Room.

and are of the surface type, having a cooling surface of 3,440 sq. ft,, which was specified to be larger than the standard practice, owing to the bad condition of the circulating water, and also the special conditions of working mentioned later. These condensers are guaranteed to maintain a minimum vacuum of 27½ in. with the whole of the steam due to the full load of the turbine—namely, 16,500 lb. per hour—passing through them. This result is obtained with 1,200 gallons of condensing water at from 65° to 75° F. The condensed steam is returned to the hot-well tank for boiler feed purposes. A prominent feature in connection with this condensing plant is that water-circulating pumps have been eliminated from the installation. The circulating water is received from the pit pumps into the two reservoirs adjoining the power house, which each contain a storage of 40,000 gallons. It then passes through the condensers by gravity, and finally to waste. The dry vacuum pumps and the hot-well pumps are of the Westinghouse-Leblanc type. The latter—one for each condenser—are located below the floor of the condenser pit, so that they may receive their water by gravity; whilst the dry air-pumps are motor driven and are located on the



View of the Main Switchboard, showing the Valve Hand Wheels, Pump Motors, and Auxiliary Switchgear under Gallery.

engine-house floor level. The dry vacuum pumps are primed by gravity from the filtration tank, shown in the outside view, and are barely visible beyond the hand-wheels in the switchboard view. They are of the Leblanc rotary valveless type, and are designed to ensure the maintenance of the high vacuum specified. The water-extraction pumps are of the vertical-shaft centrifugal type, driven by two 6-B.H.P. Westinghouse enclosed vertical-shaft motors, visible in the foreground of our view, and driving the pumps 17 ft. below, through 2-in. hollow shafts supplied by the Weldless Steel Tube Co. A Hoffman thrust bearing is fitted beneath the motor, whilst the lateral stability of the shaft is ensured by three plummer blocks.

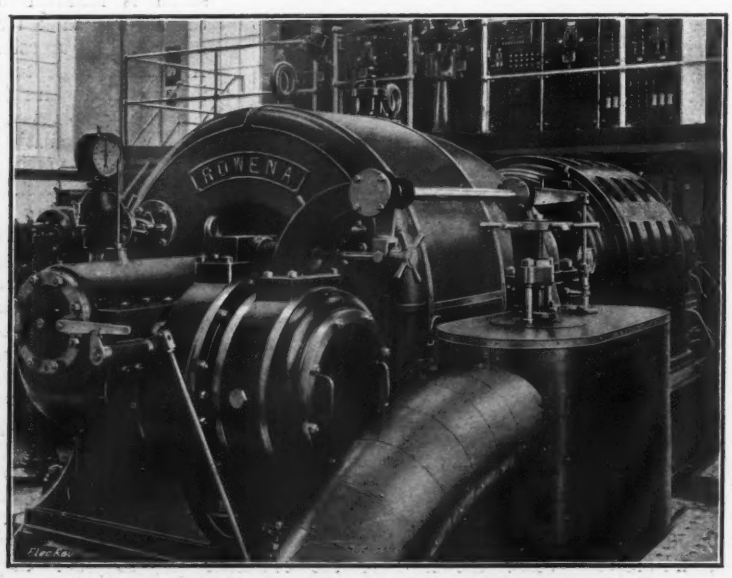
A Lea recorder is fitted between the water extraction pump

A.E.G. Cellular Switchboard in Pump Room.

discharges and the hotwell, the make-up being provided by the filtered water used for oil-cooling purposes.

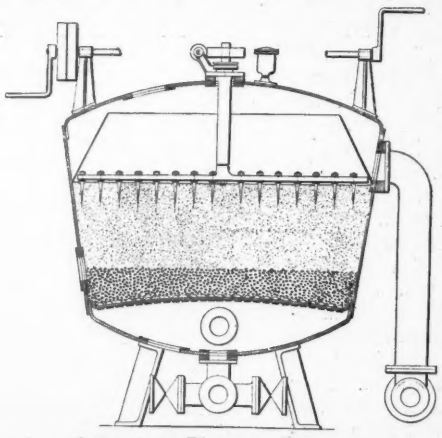
The absence of piping above the turbine floor level was especially considered by the designer, and has been accomplished by bringing the connections from all the valves, by-passes, &c., to hand-wheels on the turbine floor, thus centralising the mechanical control of the plant at engine-house floor level.

An exceedingly neat appearance is given to the engine house by this arrangement, without in any way congesting the hidden piping in the basement containing the condensers, which had to be fixed at a low level to secure the necessary head of water for allowing the water to flow through by gravity. The lay-out of the condenser pit is such that the condensers can be completely withdrawn from it for inspection and cleaning with a minimum of dismantling. Special



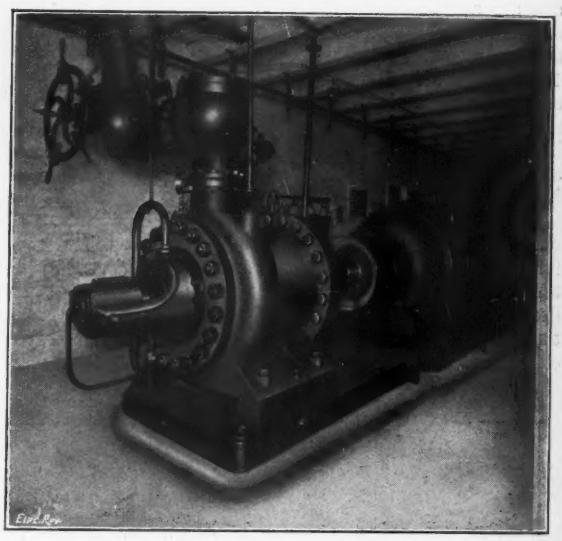
View of the Steam End, Westinghouse Turbo-Alternator.

hinged condenser doors and handholes are provided at each end to facilitate rapid cleaning, whilst particular attention



Section of Pressure Filter.

has also been paid to making all valves readily accessible for grinding and adjustment.



Sulzer Turbine Pumps at 660-ft. Level.

There is a fully equipped 8-panel switchboard of black enamelled slate, controlling the turbo-alternators with their exciters, three out-going 3,300-volt feeders, two 50-KW. transformers, reducing the pressure from 3,300 to 440 volts for power purposes and to 220 volts for lighting, and six 50-ampere low-tension feeders, three for power and three for lighting. The generators account for two panels, the 3,300-volt feeders for three, and the transformers, low-tension feeders, and the Tirrill regulator for one each. The generators are protected by reverse-current relays and the high-tension feeders by overload time-limit relays. The switchboard panels are of cubical construction and are arranged so that each is self-contained and can be isolated for cleaning purposes and inspection without danger to the operator. The doors and main switches are interlocked in such a way that the former cannot be opened whilst current is passing through the panel connections. The switchboard is erected on a gallery and is shown on page 263.

The hand wheels controlling the generator rheostats are shown at each corner of the central cantilever extension of

the switchboard gallery, and are positioned so that their operator has a clear view of the turbo sets. The two Westinghouse oil-cooled A.T.E. type transformers and the transformer switchboard will be seen under the main switchboard gallery, the switch pillars for controlling the hotwell and dry vacuum pumps being placed beside the transformers.

The high-tension cables and all the electrical connections to the switchboard are carried in troughs cut into the concrete floor of the turbine room, thus preserving a neat and workmanlike appearance for the whole equipment.

From the switchboard three feeders (by Messrs. Callender) are led to one of the shafts, where an extensive pumping installation is in use. Each feeder contains three ·158 sq. in. cores, and is paper-insulated, vulcanised bitumen sheathed and single-wire armoured; it is laid solid to the pit brow, where it is coupled at a dividing box to a similar double wire armoured cable, which is carried down the shaft, supported by wooden cleats spaced 54 ft. apart, to an inset 660 ft. down.

A 10-pair telephone cable follows the same route, coupling up the power station and offices and the underground stations.

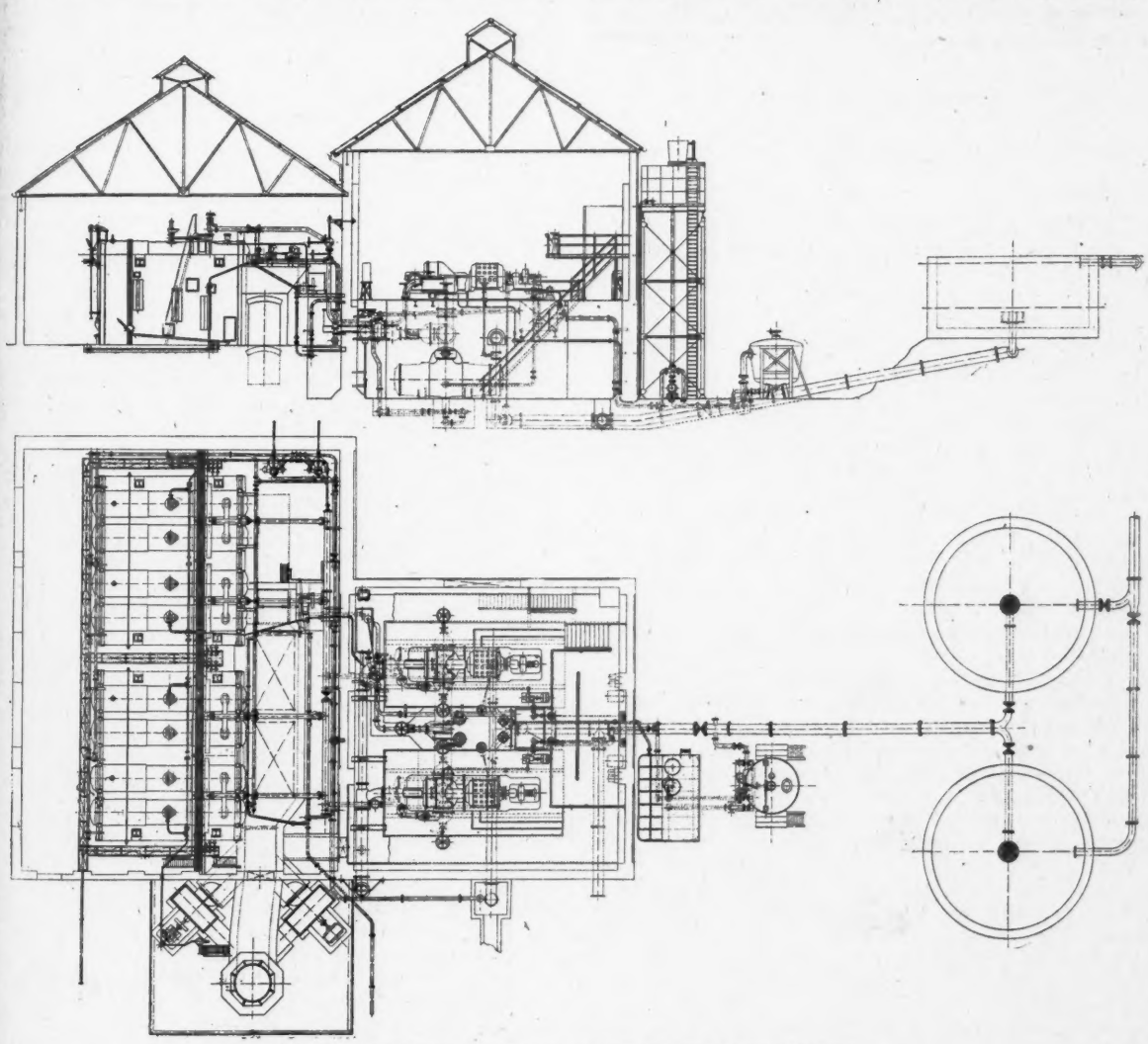
In the particular shaft to which we are referring, Sulzer four-stage vertical type sinking pumps were introduced to unwater the flooded portion of the shaft from the 660-ft. level to the 1,140-ft. level, the sinking pumps delivering water into a sump at the higher level, from which fixed horizontal pumps raise it to the pit bank.

The sinking pumps are each capable of delivering 1,200 gallons per minute against a maximum manometric head of 870 ft.

They are driven by 3,000-volt A.E.G. water-cooled motors, having a continuous output of 500 B.H.P. at 1,500 R.P.M. The horizontal pumps are also of the Sulzer 6-stage type, designed to deliver 1,000 gallons per minute against a head of 1,300 ft. Although they are installed at the 660-ft. level (the numbers of impellers being reduced to suit this head), they will later be lowered to the 1,140-ft. level. These pumps are each direct-coupled to 3,000-volt A.E.G. enclosed ventilated induction motors, with a continous rating of 680 B.H.P. at 1,500 R.P.M.

These motors are fitted with slip-ring rotor and brush raising and short-circuiting gear, and are started by means of liquid starters, provided with protective resistances.

The control of all the pumps is effected through a sheet-steel cellular switchboard by the A.E.G., installed in the 660-ft. inset pump room. There are three feeder panels for the shaft cables, one panel for each horizontal pump, and two panels for each sinking-pump motor.



Sectional Elevation and Plan of Tilmanstone Power Station.

The feeder panels are fitted with no-volt releases, pilot lamps and links for isolating the feeder oil switches.

The horizontal-pump motors are controlled by oil switches with overload and no-voltage release, the latter being interlocked with a liquid starter; this prevents the oil switch being closed unless the starter is in the starting position. One of the sinking-pump motor panels contains starting transformers, and the other the oil switch, isolating links, instrument transformers, &c. This oil switch is also provided with overload and no-volt release, the latter being interlocked with a starting transformer and emergency switch on the pump frame; owing to this interlocking, it is impossible to close the motor oil switch unless the starting transformer is in the starting position, and the motor can in

case of emergency be stopped simultaneously by the emergency switch, which trips the main oil switch.

Two panels are provided for motor "drying out;" one contains a 150-K.V.A. step-down transformer with L.T. tappings, and the other the necessary switchgear. This arrangement enables a motor which has been idle for some time, or submerged, to be dried out, the isolating links in the motor switch panels being designed as change-over switches for this purpose.

It will be seen that this pumping plant embodies the most recent practice, and that the electrical installation, both down the shaft and in the Tilmanstone power station, is of a most substantial kind.

Our thanks are due to Mr. G. F. Metzger, who, as consulting engineer, has been responsible for, and has personally supervised the carrying-out of, the whole of the work, for enabling us to publish this article, and incidentally to inspect a very interesting plant.

REVIEWS.

The Elements of Electrical Transmission. By O. J. Ferguson. London: Macmillan & Co. Price 15s. net.

This book has been published with the idea of providing an introductory text-book for colleges and technical schools. The title is quite a misnomer, since certain portions of the book are the reverse of elementary, and, moreover, the book covers practically the whole field of electrical engineering.

The opening chapter deals with conductors and insulation. The usual tables are given, and also some very useful curves for skin effect. A decidedly good feature is the large amount of information regarding specifications for cables, &c.

Line insulators are treated in a detailed and satisfactory manner in Chapter II. Modern high-tension oil-filled bushings, suspension insulators, and so on, are critically considered, and again precise information is given as to the various tests that should be imposed upon this type of apparatus. More dimensioned drawings and fewer photographs would, however, have improved this chapter.

Chapter III is devoted to poles and towers for carrying transmission lines. The various kinds of timber suitable for poles, and the different methods of preserving the timber, are thoroughly gone into. Tables are given for pole dimensions, but no method is given for investigating the strength of such poles or of lattice towers. This is unsatisfactory from the point of view of a student. Some interesting photographs are given of the gigantic power transmission schemes now in operation in the United States.

Aerial line construction receives a thoroughly adequate treatment in Chapter IV, together with the several methods used for preventing disturbance in adjacent telephone circuits. Following this is a short chapter on underground line construction, which is good so far as it goes, although troubles due to electrolysis are somewhat too briefly described.

Chapters VI treats of switchboards and protective devices. The matter is good and up-to-date regarding modern oil switches, relays and lightning arresters. A good description of the Tirrill voltage regulator is given in this chapter.

The next two chapters deal with circuits and the constants of circuits. The usual ways of feeding various types of circuits, and their relative efficiencies, are gone into, together with proofs of formulæ for the inductance, capacity and other constants of electric circuits. We are glad to see formulæ derived from exponential expansions used for line calculations.

Chapter IX is an interesting and complete account of electric generating plant. Water power and its development are dealt with in a much more detailed and thorough manner than we are accustomed to find in books of this class, gauging the flow of water, pipe discharge formulæ, water-turbines and their governors, all being clearly discussed. Steam plant and internal-combustion engines also receive the consideration they merit. The various factors affecting the choice of electric generators are then entered into, and some interesting oscillograms are used for driving home points regarding armature connections. It is stated that the cost of large machines may be taken at $15 per kilowatt. If this is so, then it may be safely stated that far better prices are obtained for electrical machinery in the United States than in this country.

Chapter X deals with the rights of way for a transmission line, sag in relation to span, wind pressure, and so on. Two examples of transmission lines are worked out.

The somewhat extensive subject of distribution is next treated of. The various types of modern high-voltage large power transformers and direct-current and alternating-current motors are well described. A considerable amount of practical information is given on air cooling for transformers, testing for water in transformer oil, the types of work suitable for different kinds of motors, and so on.

Electrical measurements are discussed in Chapter XII. Most of the ordinary types of ammeters and voltmeters are described in an unsatisfactory manner, without diagrams. Power and energy meters receive somewhat better treatment, but the same cannot be said of the description of curve tracers and oscillographs. Instruments of this character should be adequately described with the aid of diagrams, or omitted altogether. Some good reproductions of oscillograph records, and a few useful pages on harmonic analysis, are given in this chapter.

Line phenomena form the subject of the concluding chapter. The influence of inductance and capacity in causing oscillations and surges, standing and travelling waves, corona losses, and so on, are dealt with in a fashion strongly suggestive of the publications on this special branch of engineering by Dr. Steinmetz. An arithmetical slip occurs in the final formula for capacity in terms of inductance and length of line on page 437. A useful table of corona voltages is given, and also a very neat way of representing standing waves by means of co-ordinate geometry in three dimensions.

A good index is appended.

It must be remembered that while certain parts of this book are essentially of a practical character, on the other hand, a good knowledge of differential and integral calculus, complex quantities and infinite series is necessary for a complete understanding of other parts.

The book is well printed on good paper and bound in a serviceable fashion.—H.G.S.

Die Selbstanschluss und Wählereinrichtungen im Fernsprechbetriebe. By A. Kruckow. Brunswick: Fried. Vieweg und Sohn. Price 10 M. (Vol. X of Telegraphen und Fernsprech Technik in Einzeldarstellungen.)

At the present time, when the question of automatic telephony is rapidly increasing in importance, there is a distinct call for a book like this dealing critically and, more particularly, from the specialist's point of view, with the various automatic systems that have actually passed the test of practical experience.

In this country the Post Office authorities have only recently set up the first experimental lines for automatic working, but from the experience already gained in America, where numerous installations have been erected since 1895, and in Germany, where the first fully automatic system has been at work since 1908, there is little doubt that considerable extension in this direction is to be looked for in the near future.

The writer assumes a general knowledge of ordinary telephone working, and throughout points out the alterations introduced by the automatic systems into the older method of working, and he compares the two with regard to cost, speed of operation, &c. The systems dealt with more particularly include that of the Automatic Electric Co. (Strowger), the Siemens & Halske modification of it, the Rochester Co.'s system, the Austrian State system (Dietl), the Lorimer system, and that of Betulander.

The book is divided into 12 chapters.

Chapter I deals with the various automatic calling devices. In Chapter II the call-office connections and the various types of wall and table apparatus in use are considered. Chapters III and IV describe the construction and operation of the most important part of the apparatus, viz., the selector switch at the exchange, by means of which the subscriber is automatically connected to any desired number.

Chapter V deals with various auxiliary apparatus by means of which engaged lines are indicated, the duplicate use of engaged lines is prevented, calls are metered, &c. In Chapter VI the trunk line connections are discussed. Chapters VII and VIII deal with the actual internal arrangements of the exchanges, and with junction line working. Chapters IX and X deal with sub-stations, and with the use of automatic working for small country groups of subscribers. In Chapters XI and XII the question of semi-automatic installations, and the use of automatic selectors as labour-saving devices in hand-operated exchanges, are considered.

The descriptions and diagrams are admirably clear throughout, and the book as a whole will give a very fair idea of the present state of automatic working to any reader already familiar with existing telephone practice.

Aitken's Manual of the Telephone. By W. Aitken, M.I.E.E. London: The *Electrician* Printing and Publishing Co., Ltd. Vol. I. Price 18s. net.

This is the first of two volumes intended to cover the whole field of commercial telephone engineering.

The present volume opens with a description of the principle of the telephone, and of the development of the telephone system of this country. The whole subject of subscribers' instruments and circuits, and of exchange working, is then dealt with, from the simple private telephone installation, through magneto and common-battery exchanges, to the modern developments in automatic exchange working. The various systems of junction and trunk line working are also included in this volume.

Each section is treated very fully, and the early methods which were used are described, as well as those in use to-day. A large amount of this matter, however, seems somewhat superfluous in a book intended for the modern telephone engineer, who usually has no great desire to learn how certain results were obtained in the past, more especially as to make a full study of the arrangements in use at present is a task of no mean magnitude.

The line of demarcation is not very clearly drawn between arrangements which are obsolete and those which, although old, are still in service. In a few cases, even, obsolete methods are described as if they were actually in use. For instance, in the section dealing with the Post Office trunk-line arrangements, a method of signalling is described as being present-day practice, although, as a matter of fact, the system in use nowadays is quite different.

A number of the illustrations seem scarcely necessary in a book intended to be read by professional telephone men. We also notice that, from fig. 219 to fig. 242, the illustrations are not numbered consecutively. This want of numerical order is very annoying when endeavouring to turn up a particular figure for reference. It would be a great improvement in subsequent editions if this were remedied and the numbers of the illustrations arranged to run consecutively throughout the volume.

The book, on the whole, is a very useful work of reference, but we feel that, at any rate, as far as the greater number of telephone men in this country are concerned, a considerable amount of the matter contained in it could be deleted with advantage. If the author had confined himself to present-day practice in this country, the book could have been produced for a less price, and would have been more generally useful to telephone men here. Of course, the lines on which the book is written render it useful, not only in Great Britain, but all over the world, but also, we are afraid, seriously restrict the number of people who can afford to obtain it.

Glasgow Electrical Strike Ended.—After a month's strike, a settlement was arrived at on Tuesday, 13th inst., between the members of the Electrical Workers' Union and their employers. A conference was held between representatives of both sides in the Electrical Contractors' Association offices, and after a lengthy sitting an agreement was come to on the wages question. It is understood that there were mutual concessions, and work was accordingly resumed.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The Wrexham T.C. has increased the salary of the electrical engineer from £250 to £275 per annum.

We are informed that Mr. A. Nicholls has resigned his position on the City sub-station staff of the Charing Cross, West End and City Electricity Supply Co., to take up an appointment in Canada. On behalf of the employés of the City section, Mr. Brazil—the head of the department—presented him with a case of drawing instruments, as a memento of over 10 years' association with the company.

The salary of Mr. J. B. Feltham, chief assistant engineer at Gloucester Corporation electricity works, has been increased to £180 this year, with a further increase of £20 to £200 per annum in January, 1913.

Mr. Wardrop, electrical engineer to the Elland U.D.C. has resigned.

Mr. H. Fox has resigned the position of engineer and manager to the Roundhay Electric Light Co., and is going abroad on account of his health. The chairman and directors have presented him with a purse of money. Mr. Wardrop, of Elland, has been appointed to succeed him, and all business communications should be adressed to him in future.

On Monday last Mr. Harold A. Smith, who has just been appointed to take charge of the test room under the Leith Corporation, was presented with a keyless chronograph watch from the staff and workmen of the Aberdeen Corporation Electricity Department. Mr. Smith was also entertained to supper in the Station Hotel, Aberdeen, on the previous Saturday evening.

Tramway Officials.—The Burnley Corporation Tramways Committee has decided to recommend the Council to increase the salary of the tramways manager from £400 to £450 per annum as from February 7th, and thereafter by two annual increments of £25, bringing the total to £500.

At a meeting of the Newcastle-on-Tyne City Council on the 8th inst., the Tramways Committee recommended that the tramways manager's salary be increased from £800 to £900, and that it be further increased to £1,000 a year hence. The report was adopted.

Mr. Hy. Bench has been appointed general permanent way foreman in the Blackpool Corporation Tramways Department.

General.—Following our recent announcement that Mr. H. B. Renwick had been elected to a seat on the board of the County of London Electric Supply Co., Ltd., as managing director, we now understand that he has, in consequence of the additional duties involved, found it necessary to resign the chairmanship of the Electric Supply Publicity Committee.

Mr. Hubert Jones, late of the Installation Inspectors' staff of the Manchester Corporation Electricity Department, was on Saturday last the recipient of a set of carvers, presented to him by his colleagues. The presentation was made by Mr. Marlor, Chief Installation Inspector. Mr. Jones, who has been with the Corporation for 10 years, has joined the firm of Messrs. E. M. Evans and Sons, electrical contractors, Manchester.

Mr. Alfred Schwartz has resigned the Professorship of Electrical Engineering in the Manchester University and the School of Technology, on his appointment by the President of the Board of Education to a Staff Inspectorship in Engineering under the Board. The resignation dates from March 31st next.

We are asked to state that Mr. Sherard Cowper-Coles has entirely severed his connection with the Cowper-Coles Engineering Co., Ltd., and has removed to new offices and laboratories at 1 and 2, Old Pye Street, Westminster.

Mr. Robert James Hatton has been elected to a seat on the board of W. T. Henley's Telegraph Works Co., Ltd. Mr. Hatton has been the company's chief engineer and works manager for many years. Congratulations, Mr. Hatton!

The *Review of the River Plate* says that Mr. Pakenham W. Beatty, who has been appointed the South American representative and manager of the Edison & Swan Electric Light Co., arrived in Buenos Ayres in January, and will shortly open offices in Buenos Ayres and Rosario, and in several cities in Brazil and Chile.

The *Australian Mining and Engineering Review* of January 5th reported that Mr. J. M. Jolly, engineer and manager of the Australian Metal Co. (electrical department), was to leave on a six months' business trip to Europe and the United Kingdom.

Mr. H. F. Marchant has been appointed secretary of the Armorduct Manufacturing Co., Ltd., in succession to Mr. J. S. B. Plummer.

Our congratulations to Sir William Preece, K.C.B., F.R.S., upon the celebration yesterday of his 78th birthday. "Many happy returns!"

Obituary.—The death occurred on Saturday of Mr. David Rosser, electrical engineer on the Golden Grove Estate of Earl Cawdor.

On February 12th Mr. Ellis Kerry, one of the earliest railway telegraph clerks in the kingdom, died in his 87th year. His first appointment was on the Norfolk Railway, at a time when the charge for a 20-word telegram between Norwich and Yarmouth was 7s. 6d.

We regret to record the death of Sir Henry Oakley, a former chairman of the Central London Railway.

NEW COMPANIES REGISTERED.

British and Overseas Engineering Syndicate, Ltd. (120,175).—This company was registered on February 10th, with a capital of £1,000 in £1 shares, to carry on the business of engineers, founders, manufacturers of machinery, tool makers, metal workers, suppliers of electricity, &c. The subscribers (with one share each) are:—S. G. F. Steadman, 4, Suffolk Street, Pall Mall East, S.W., solicitor; F. S. Gaylor, 4, Suffolk Street, Pall Mall East, S.W., solicitor. Private company. The number of directors is not to be less than two or more than five; the first are S. G. F. Steadman and F. S. Gaylor; remuneration, £100 per annum, divisible. Registered office, 4, Suffolk Street, Pall Mall East, S.W.

Naylorgraph, Ltd. (120,069).—This company was registered on February 5th, with a capital of £3,000 in £1 shares, to take over certain patents, designs, &c., relating to electrical signs, and to adopt an agreement with J. P. Naylor. The subscribers (with one share each) are:—J. M. Hunt, Fairlawn, Southborough, gentleman; J. P. Naylor, 57, Croxted Road, Dulwich, S.E., electrical engineer. Private company. The number of directors is not to be less than two or more than five; the first are J. M. Hunt (permanent chairman, subject to holding 1,000 shares), and J. P. Naylor; qualification, £200; remuneration as fixed by the company. Registered office, 57, Croxted Road, Dulwich, S.E.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bullers, Ltd. (62,020) (Formerly Buller's Telegraph Construction, Ltd.).—Return dated December 7th, filed December 14th, 1911. Capital, £400,000 in £10 shares (20,000 preference). 15,000 ordinary and 15,000 preference shares taken up, £10 per share called up on seven ordinary and 15,000 preference; £150,070 paid; £149,930 considered as paid on 14,993 ordinary. Mortgages and charges: Nil.

City of Ely Electric Light and Power Co., Ltd. (85,444).—Return dated January 12th, 1912. Capital, £5,000 in £1 shares; 3,003 shares taken up; 2s. per share called up; £300 6s. paid. Mortgages and charges: Nil.

Chilian Construction Co., Ltd. (111,448).—Return dated January 18th, 1912. Capital, £500,000 in £1 shares; two shares taken up; £2 paid. Mortgages and charges: Nil.

H. Laughton & Co., Ltd.—Particulars of £300 debentures, created January 19th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Engineering Instruments, Ltd. (66,427).—Debenture dated January 19th, 1912, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: W. D. Forster, Darlington; and T. E. Hodgkin, Collingwood Street, Newcastle-on-Tyne.

CITY NOTES.

Dublin United Tramways Co., Ltd.

MR. W. M. MURPHY presided, on 6th inst., at this company's meeting held at the Imperial Hotel, Dublin. In moving the adoption of the report, he said that the large increase in passenger receipts (£12,022) for the half-year was mainly due to the visit of their Majesties to Dublin last July, and to the exceptionally fine weather. The total receipts were £169,249, against £157,254, an increase of £11,995, most of which they were able to retain as additional profit. The working and general expenses were £85,539, an increase of £2,222, and the working expenses of all kinds showed an increase of only £2,347. The total expenses were 51·6 per cent. of the gross receipts, or 5·383d. per mile run. The speaker said that he did not think there was any parallel in the kingdom of a tramway where the plant and track were nearly 14 years old, kept in the highest state of efficiency and run at a cost for all expenses, including rates and taxes, at less than 5½d. per mile. The net revenue available for distribution was £68,076, or £12,278 more than for the second half of 1910. After paying the usual dividends of 6 per cent. per annum on the preference and ordinary shares, they proposed a bonus equal to 1 per cent. on the ordinary shares. After that they set aside £14,000 to reserve for renewals of permanent way, £2,000 to accident insurance reserve, £5,000 to reserve for renewal of cars, carrying forward £10,374, £476 more than a year ago. Last year they set aside £12,000 toward permanent way renewals, but they had not drawn on any of that yet. The chairman went on to refer to track renewal work required this year and in later years, and he said that if they continued to build up a substantial reserve they would be able to secure the payment of steady dividends when the time came for renewal on a large scale. They would have to renew some of the oldest cars in the near future. The principal capital expenditure had been for a 1,500-KW. exhaust steam turbo-generator which had been in operation since November with most satisfactory results. They had reduced the consumption of coal per unit from 4½ lb. to 3½ lb., and the total saving expected through the use of this set was estimated to exceed 3,000 tons of coal per annum.

The report was adopted.

London Electric Wire Co. and Smiths, Ltd.—

The directors have declared a dividend of 7½ per cent. (7s. 6d. per share), less income-tax, on the ordinary shares for the half-year to December 31st, making 10 per cent. for the year. £15,000 is placed to reserve making £30,000, £500 is reserved against fall in market price of investments, and £10,913 is to be carried forward.

Smithfield Markets Electric Supply Co., Ltd.

SIR HERBERT S. LEON, Bart. (chairman), presided on Friday at Winchester House, E.C., over the fourteenth ordinary general meeting of the above company.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, page 226), said he had little to say because the past 12 months had been very uneventful. They would notice that the capital account had been reduced by £2,397 and now stood at £114,326. This reduction was entirely due to the scrapping of some of the plant in preparation for the installation of some new up-to-date machinery. The cost of this new plant, to which reference was made last year, did not yet appear in the balance-sheet, but a note had been made to the effect that the payment of the money to the contractor became a liability directly the new engines were at work. There were some physical difficulties to be surmounted, but he hoped they would excuse any explanation as to details. As a matter of fact, as he was not an engineer, he was not really competent to answer questions on such a technical matter. However, he was glad to say both the engineers and contractors were doing their best to overcome what they hoped would be only a temporary difficulty. The worst of it was that all these things seemed to move so slowly to the ordinary lay mind. If they turned to the revenue account it was satisfactory to note a decrease in most of the items on the debit side of the account. The cost of generation and distribution was slightly higher. It worked out at 2·7 per cent. more, but against that there had been an increase in revenue of 6·75 per cent., so that there was an increase in gross profit of not less than 25 per cent. They would see that the profit had been improved by £839, or 58 per cent., from which £500 had been placed to depreciation account and £400 to the debenture redemption fund. The available balance including the amount brought forward from last year was £1,829. The board had decided to recommend from this a dividend of 2 per cent., which would absorb £1,200, and to carry forward £629. He did not want to appear in any way pessimistic, but he desired to emphasise the fact that the cost of production could not be reduced below a certain figure which left the margin of profit very small, and therefore this dividend was not likely to be increased. Then there was always the possibility of a new lamp being introduced which would still further reduce the consumption of current, and when that came, the electric lighting companies would have to face the new circumstances. Satisfactory progress had been made in the markets during the year, inasmuch as the consumption of current had increased, and the yield per lamp installed was considerably higher.

MR. J. BROWNE MARTIN seconded the motion, which was carried.

The CHAIRMAN moved the formal resolution for the declaration of the dividend, and

MR. J. BROWNE MARTIN, in seconding, said he did not quite agree with the Chairman when he said he did not think they could pay more dividend. He believed they would.

The resolution was carried.

Cambridge Electric Supply Co., Ltd.—

The directors' report states that during the year 1911 there have been connected 179 additional consumers, having the equivalent of 5,307 (30-watt) lamps, making a total of 76,294. Units supplied were 700,587, an increase of 68,320 units. The number of consumers continued to increase, and additional mains have been laid. The popularity of metal-filament lamps continues, and has led to large reductions in the cost of lighting. £4,515 has been transferred from the depreciation account for the purpose of writing off plant which has become obsolete. For the year there is a total profit of £8,885, which, added to £874 brought forward, makes £9,760. After deducting debenture and other interest £1,866, placing £2,750 to depreciation fund account, which will bring up the total placed to the credit of that account to £18,250, there remains a balance of £5,144. An interim dividend of 2 per cent., absorbing £1,696, has already been paid, and the directors recommend the payment of a further dividend of 3 per cent., making 5 per cent. for the year. This will absorb £2,544, leaving about £903 to carry forward.

Bruce Peebles & Co., Ltd.—

The annual report for 1911 shows an improvement of £7,629. The profit, after deducting maintenance, general charges and debenture interest, is £354.

Crossley Bros., Ltd.—

The directors report a decrease in profits due to serious labour troubles and consequent reduction in output. The dividend on the ordinary shares is to be 4 per cent for the year, £10,000 being placed to reserve, and £30,020 carried forward.

Llanelly and District Electric Light and Traction Co., Ltd.—

The directors' report (as abstracted in the *Financier*) states that the profit for the year to December 31st, including £56 brought forward, and after payment of loan and debenture interest charges, is £4,585, out of which the interim dividend of the 6 per cent. cumulative preference shares to June 30th, 1911, amounting to £1,761, has been paid, leaving an available balance of £2,824 The directors recommend the payment of the dividend on the 6 per cent. cumulative preference shares for the half-year to December 31st, 1911, £1,800, carrying forward £1,024. The progress made by the company in the tramway, lighting and power departments has been entirely satisfactory, necessitating extensions of the plant, some of which were completed during the year, and others are now in hand. The tramways were completed early in August, 1911, so that the full system was only in operation for about five months.

Northampton Electric Light and Power Co., Ltd.

The directors report that the record of the past year's working shows continuous improvement. Lamps and motors added (all reckoned as 32-watt lamps) 17,810, making a total equal to 125,161 lamps. The horse-power of motors added is 449, making a total of 2,162 H.P., of which 1,815 are hired from the company. The mains added were 3 miles 782 yards in extent, making a total of 28 miles 977 yards, besides feeders added, 1,093 yards. The principal extensions are to Garden Suburb (Far Cotton), Weston Favell, and Harborough Road. The current sold for lighting and power has increased 26 per cent., the total units being 2,497,871, as against 1,978,974 in the previous year. The maximum load on plant was 1,566 KW. (22¾ per cent. increase), the load factor 18·1, as compared with 17·7 in the previous year, and the working costs per unit sold show 5 per cent. decrease. The new plant referred to in the last report is now in working order; a considerable extension of the engine house has been effected, and many other additions and improvements have been made. Additional shares to the number of 13,346 were offered at a premium of 5 per cent., and were readily taken up by existing shareholders and their friends, and allotted in October last—namely, 11,525 as ordinary shares, and 1,821 as 5 per cent. preference shares. This brings up the total share capital to £100,000, the full amount at present authorised. The depreciation account has been increased by £5,200 (out of which £170 has been written off plant, £400 off accumulators, £250 off demolished buildings, and £725 off mains), also £350 has been written off motors, and £1,300 added to reserve. The sum of £704 will be required for the dividend on the 5 per cent. preference shares, and the directors propose that 7 per cent. per annum should be paid on the ordinary shares for the half-year (making 6 per cent. for the year), £2,047; also £102 interest on instalments on new shares, leaving £1,850 to be caried forward.

Fife Tramway, Light and Power Co., Ltd.

Mr. William Low, of Blebo, Cupar-Fife, moving the adoption of the report at the annual meeting of this company, stated that the results achieved in 1911 were satisfactory. The revenue from the tramways amounted to £12,600, an increase on the previous year. Owing to the necessary capital expenditure in other directions, the extension of the tramways to Lochore had been left over to be dealt with this year, and it was proposed to undertake this extension in the course of the next few months. The directors are of opinion that this extension will materially add to the revenue the company will receive from the tramways undertaking. During the latter part of the year the Power Co.'s transmission lines were extended from Lochgelly to Wemyss, a distance of 12 miles, for the purpose of supplying the Wemyss and District Tramways Co. The supply was given to the tramway company at East Wemyss, which was 23½ miles from the Power Co.'s generating station, and the tramway was operated from the company's power station early in December last. The whole capital to build this extension to Wemyss had to be provided last year, but only one month's revenue was received. This year the Power Co. would have the benefit of a full year's revenue from this source. The directors proposed to continue to extend the transmission lines, and paticularly with as little loss of time as possible to connect the coast towns from Leven to Inverkeithing, and to connect Kelty in order to give a power supply, and also a supply in accordance with electric lighting orders granted to the company. The revenue from the power and lighting department amounted to £4,400, compared with £2,265 for the previous year. The capital of the company had been increased to £300,000, and £34,445 additional ordinary shares had been placed at par without underwriting commission. This brought the total ordinary shares issued up to £93,250. After providing for preference dividend there was a surplus on the year's working of £3,658, to which had to be added £3,090 brought in from last account, making a total of £6,748, which the directors recommended should be carried forward.

City of Buenos Aires Tramways Co., Ltd.—The directors' report for the year 1911 states that the annuity payable by the Anglo-Argentine Tramways Co. has been received, and the net revenue for the year has amounted to £65,726. Interim dividends have been paid for the nine months ended September 30th, 1911, absorbing £46,500, leaving a balance of £19,226. The directors recommend that in addition to the interim dividends already distributed, a final dividend of 1s. 3d. per share (making 5s. per share, less income-tax) be paid for the year ended December 31st, 1911, absorbing £15,500; that £3,650 be transferred to general amortisation fund, and that £76 be carried forward.

Farnham Gas and Electricity Co., Ltd.—At the second ordinary general meeting, held at Farnham on Monday, Mr. A. J. Nash, C.C., the chairman, said that the electricity works were in a forward state, and a supply of electricity would be afforded this spring. They had entered into contracts for buildings, switchboard, engines, electrical machinery and cables, amounting to £11,013.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the five weeks ended December 29th, 1911, were 829,464, compared with 660,633 units in the corresponding five weeks of 1910.

St. James' and Pall Mall Electric Light Co., Ltd.

The meeting was held on Tuesday at the offices, Carnaby Street, Golden Square, Mr. Walter Leaf presiding.

The Chairman, in moving the adoption of the report (see Electrical Review, page 227), said that it contained nothing of an exceptional or sensational character. What differences there were in the accounts were, without exception, on the right side. They hoped 12 months ago that the loss of revenue due to the metallic-filament lamp had been overcome, and he was glad to say that that hope had been fully justified. The units sold had increased by 808,973; connections to the amount of 976 KW. had been added, and the gross revenue had been advanced by £2,297. The costs had also increased by £1,058, so that the balance carried to net revenue account was larger than last year by £1,259. He trusted they would regard that as evidence of steady growth, the outcome of a very steady policy; and he saw no reason why, if trade conditions did not take a turn for the worse during the year, that growth should not be maintained. Rebuilding in the district was going on very satisfactorily, and they had just settled a contract with Messrs. Lyons to supply a new hotel they were erecting, which would be one of the largest in London. The important changes at Mason's Yard to which he referred last year had been carried out, and the entire cost of reconstruction had been provided by funds set aside for that purpose. The steam generating plant there had been removed, and the station was now equipped for the transmission of high-tension current supplied from Grove Road, with a large storage battery, which would be a most valuable stand-by in the case of any accident. The results had been so satisfactory that they had decided to carry out a similar improvement in part of the Carnaby Street plant. Two-thirds of the original boiler plant had been brought up to date, now consuming bituminous coal with a large saving of cost. Two-thirds of the steam plant, with an output of 13,220 KW., would remain fully efficient. The remaining plant of about 1,400 KW. was approaching a point where it would have to be regarded as obsolete, and their engineer advised them that they should make provision at once to substitute for it in the course of the next two years transformers designed to utilise a larger supply from Grove Road. The cost of scrapping the plant on which no further dependence could be placed was estimated at about £10,000. That sum they proposed to spread over three years. They had already made provision for £2,500 by the additional amount which they had this year taken under the head of depreciation; they had provided £4,500 which they had added to the contingency fund, and the balance they hoped to obtain without the least difficulty from the revenue of next year. To meet the load of the plant which they were now abolishing, the Central Co. had at their request placed an order for a new 3,000-KW. turbine generator of the newest design. There was room for that plant in the existing buildings at Grove Road. That new unit would, in the terms of the contract, be erected and running in time to take its share of next winter's load, and they looked forward with confidence, based on the experience of the past, to a further gain in economy and efficiency. Every year confirmed them in the belief that they did well to establish a bulk station in Grove Road, and they were constantly relying more upon it and looking to it for all future expansion. The Central Co. was now a vital part of their system. The day of scattered stations and small units was passing away, and although the process was a gradual one, they were looking forward to the time when all supply would be in bulk from large distributing centres, the older stations being used for distribution only. It was the constant policy of the board acting under the able technical advice of its managers to work steadily towards that end which was bound to come, and to facilitate by cautious foresight the steps which would enable them to attain it without waste and without hurry. In all respects but one, the outlook for the year was promising. They anticipated a growth in revenue, their relations with the London Co. whose alternating supply they had taken over had been most friendly. Their men were loyal and contented; even the turbulent times of last August left them unmoved. So long, however, as the danger of a great coal strike hung over the country, those who were responsible for a large industry must feel grave apprehension. They had made their preparations for the worst; and there, again, the possession of the Grove Road station had been of invaluable assistance to them. They had also spare land there, and they had laid in a reserve stock of coal which would enable them at this time of the year to carry on their supply for 10 weeks, even if it should be impossible during that time to buy a single ton. But for the central station they could not have made that provision which, in his opinion, would serve them up to that point at which the cessation of output would mean a disaster which would have to be dealt with by other means than private foresight.

Sir John H. Morris, K.C.S.I., seconded the motion, which was adopted without discussion.

Lytham Electric Light and Power Co.—The scheme for the formation of this concern is not being proceeded with, the main reason being lack of interest on the part of local residents. The issue to the public was 10,000 ordinary shares of £1 each. Only 21 applicants sent in for 1,357 shares.

London Electric Supply Corporation, Ltd.—The profit for 1911 was £61,412, against £53,225 for 1910. After paying 6 per cent. preference dividend, 2½ per cent. is to be paid on the ordinary, £5,000 is to be placed to reserve, £5,000 to contingencies, and £4,186 carried forward. The power supplied for traction purposes increased by 73 per cent., and that for industrial purposes by 87 per cent

Electrical Distribution of Yorkshire, Ltd.

The directors' report for the year ending December 31st, 1911, again shows satisfactory progress. The gross profit for the three corresponding yearly periods ending December 31st, is as follows:—1911, £1,416; 1910, £751; 1909, £238. After deduction of interest paid and accrued the balance of the profit and loss account for the same period is:—1911, £1,347; 1910, £515; 1909. £184. The balance of the profit and loss account of £1,347, with £109 brought forward, makes a total disposable balance of £1,456, which the directors recommend should be dealt with as follows:—Dividend for the year 1911 at the rate of 4 per cent. per annum (free of income-tax) on the ordinary shares, £680; write off formation, preliminary and working expenses, £428; carrying forward, £348. During the year a considerable number applications for the supply of current have been received, and the company is now supplying in Calverley, Castleford, Farsley, Gomereal, Hipperholme, Horsforth, Liversedge, Ossett and Sowerby Bridge. Applications are being made to the Board of Trade during the Parliamentary session of 1912 for Electric Lighting Provisional Orders empowering the company to supply within other districts in the West Riding. The Urban District Council of Birstall has applied to the Board of Trade for consent to transfer its Electric Lighting Provisional Order to the company, and the Urban District Council of Greetland has applied for an Electric Lighting Order for the Urban District of Greetland, and has agreed, in the event of such Order being obtained, to transfer the same to the company. The company has now arrived at a profit-earning position, and the directors draw the attention of the shareholders to the fact that up to this time no payment has been made to them for expenses incurred or for services rendered. The directors suggest that this matter should be considered when the accounts for 1912 are dealt with a year hence. Mr. Henry Barran, of Leeds, has been appointed a director.

Since the approval of the report by the board, the chairman (Mr. John Nevin), who has filled that office from the formation of the company, has died (February 4th).

Central London Railway Co.

Mr. H. F. Parshall (chairman) presided, on February 8th, at the Holborn Restaurant, over the twenty-third ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 227), the Chairman said that, dealing first with the capital account, there had been a recent issue of £385,000 4½ per cent. preference stock, for which they had received £383,300, leaving £1,700 still to come in. During the past half-year they had spent £65,287 on capital account. Of this sum £60,239 had been spent on the new line to Liverpool Street. With regard to this extension, the progress of the work had been somewhat retarded owing to the national strike last year, and to various other causes, but he was pleased to say that, owing to the strenuous efforts of their engineers, there was every possibility of the line being open for traffic about the middle of the present year. They had also spent £1,211 in connection with the Ealing extension, for Parliamentary and engineering expenses. All the preliminary details in regard to this valuable extension had now been settled, and the necessary plans had been agreed between the Great Western Co. and this company, so that the constructional work would be commenced forthwith. The estimate of further expenditure on capital account was £123,500 during the ensuing half-year, and £246,500 in subsequent half-years. To meet this expenditure of £370,000 there were unissued preference and debenture stocks (including the small balance due on the former) amounting to £256,700, which, with the balance at credit of capital account of £141,383, made a total of £398,083. Coming to the revenue account, during the last half-year the railway had carried over 18 million passengers, which, compared with the same period last year, was a decrease of approximately 1,900,000 passengers, and a decrease in receipts of £18,312. This decrease in passengers could be attributed to the increased motor-'bus competition, the unprecedented spell of fine weather which prevailed rendering the motor-'bus more attractive than their tube as a mode of conveyance, to a most disappointing Exhibition traffic, due very largely to the number of counter-attractions which were running simultaneously, and also to the loss of traffic owing to the railway strike. Against this decrease in passenger traffic there was an increase in miscellaneous receipts of £590, so that the net decrease in revenue receipts was £17,037. This decrease was equal to 9·6 per cent. in passengers and 12·77 per cent. in receipts, and was at every station and included all classes of traffic. Looking at the favourable side of the half-year's working, they would see that there had been a very considerable decrease in the expenses amounting to £14,833, which result had been accomplished without in the slightest degree impairing the efficiency of the railway; in fact, more had been spent on the upkeep of the railway this half-year than in any corresponding period since the line had been open. The figures given in the report did not represent the results of all the economies which had been effected, since steady progress was being made in this direction. The decrease in expenses was accounted for as follows:—General working, £7,814; rates and taxes, £6,765; and sundry items, £254. The percentage of working expenses to traffic receipts for the half-year were 58·58 per cent., against 61·72 per cent. in the corresponding period of last year, being a decrease of 3·14 per cent. The cost per car-mile had decreased by ·36d., which gave an increased net traffic receipt per car-mile of ·23d. The cost per passenger had been ·98d., against 1·06d., a decrease of ·08d., giving a net increased receipt per passenger of ·02d. The gross receipts amounted to £138,552, and after deducting working expenses, there was a balance to net revenue of £64,856. After providing for debenture interest and other payments, the net revenue account showed that with the amount of £30,655 brought forward from last half-year, and the sum of £5,883 to meet the dividend on deferred stock, there was an available balance of £83,170. Interest on the 4½ per cent. preference stock would absorb £6,136, leaving a balance of £77,035. A dividend on the undivided ordinary stock at the same rate as last half-year, viz., 3 per cent., would absorb £27,351; 4 per cent. on the preferred ordinary stock would absorb £11,766; and 2 per cent. for the whole year on the deferred stock would absorb £11,766, making a total of £50,883, leaving a balance to carry forward of £26,552. In the revenue account there was an item of £1,756 under "strike expenses." In regard to the strike of August last they took every possible precaution beforehand to ensure a good train service being maintained, and he was pleased to say that in consequence the company suffered very little inconvenience. It was very satisfactory to note that with the exception of the motor drivers the majority of the employés remained loyal. They had among their staff a number of men who had been thoroughly trained to, and were capable of, driving the trains. When the regular drivers deserted their posts, these emergency drivers, as they termed them, stepped into their places, and thus a full train service was easily maintained. There were no delays, and the public experienced no inconvenience. In the final event the Board of Trade intervened. They represented to the company that this was not a local matter, but was a national matter, and that the company could not fairly stand out and say they could not take the men back, although there was no need for taking them back, and, in fact, they would have been better pleased not to have had them. But in order to meet the Board of Trade these men were taken back, and, to illustrate the state of affairs, he might say that the men made no representations that they wished anything more from the company either in wages or shorter hours or more privileges. They simply went out out of sympathy. The sale of season tickets which was introduced last July had proved very satisfactory, and their passengers had expressed themselves as being greatly pleased with the facilities afforded. Every effort was being made to bring the various facilities afforded by the railway prominently before the public by means of advertising. A good deal had also been done in the matter of lighting and renovating their stations with a view to making them more attractive to the travelling public.

Viscount St. Aldwyn seconded the motion.

Mr. Walford complimented the board and the staff on the decreased working expenses and also on the great push shown in order to get more travellers on the line.

Mr. Roberts asked if the board could not compete with the 'buses between Tottenham Court Road and the Bank.

Mr. Fitch considered that if the improved ventilation of the line could be impressed on the public it would do good. He considered it the healthiest and most satisfactory line to travel on in London.

Sir Charles Cuffe expressed the hope that the extension at Wood Lane would be pushed on rapidly.

Mr. Anderson thought they must admit that the railway could not compete with the 'buses for short-distance traffic, and hence their hope lay in extensions. He would like the board to give them more particulars with regard to the policy of extensions, and whether they had considered the question of carrying the railway by means of a loop from Ealing through Brentford, Hanwell, Kew and Chiswick.

The Chairman said that with regard to competing for traffic between Tottenham Court Road and the Bank, at present they saw no new departure; when Liverpool Street Station was opened they would have more flexibility in meeting their competitors. The board recognised that they must extend, and the joining up at Wood Lane would be carried out as soon as possible, but the great bulk of the work had to be done by the Great Western Co. first, and pending that work being done, the board was not tying up the company's money. He did not know that he was entitled to make any specific statement regarding any extension, but he might say the board did not consider their programme was in any way a closed one; and, in fact, his own view was that they had only begun, and if the present extensions brought the results they anticipated, then the best policy of the railway would be to extend largely into the country and make themselves independent of local competition.

The report was then adopted.

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in and to grant a quotation to—

Automatic Telephone Manufacturing Co., Ltd.—100,000 ordinary shares of £1 each, fully paid; and 200,000 cumulative 6 per cent. preference shares of £1 each, fully paid (special application).

And to allow the following to be quoted in the Official List:—

Mexican Light and Power Co., Ltd.—£1,000,000 5 per cent. second mortgage 50-year bonds, in lieu of the scrip.

Chelsea Electricity Supply Co., Ltd.—The directors recommend a dividend for the half-year to December 31st, 1911, at the rate of 6 per cent. per annum on the ordinary share capital of the company, making 5 per cent. for the year 1911, after paying debenture interest and placing £13,180 to depreciation fund, £704 to debenture premium redemption fund, and writing off £1,089 from the cost of extinction of founders' shares, and £1,000 from cost of purchase of Cadogan Electric Light Co., carrying forward £3,240 as against £2,290 in the previous year, subject to audit. The dividend is the same as last year, and will be payable on and after March 15th.

Underground Electric Railways Co. of London, Ltd.

The directors' report says that the result of the half-year ended at December 31st, 1911, continues to show a substantial improvement. The net revenue from investments and properties (including general interest), after deducting general expenses, amounted to £104,045: amount receivable under guarantee on Metropolitan District Railway assented first preference stock £2,687, making £106,731. The net income from the operation of the power house was £45,918; the interest on £1,000,000 4 per cent. first power house debentures, and a proportion of commission, discount and expenses incurred in connection with the issue, absorbed £20,870, leaving a surplus from the power house of £25,048, making £131,779. The service of the £1,000,000 5 per cent. prior lien bonds, including the expenses of redemption, absorbed £10,415; the service of the £2,818,700 4½ per cent. bonds of 1933 absorbed £67,349, leaving a surplus over half-yearly charges of £54,015, which will be applied as follows:—Interest at the rate of 2 per cent. per annum on £4,928,050 6 per cent. income bonds of 1948, £49,280; income-tax, £3,053; to reserve applied in reduction of the accumulated revenue deficiencies, £1,682.

The traffic of the railway companies and of the London United Tramways, Ltd., in which the company is interested, continues to show satisfactory increases, notwithstanding the fact that the traffic on the railways was adversely affected by the extraordinarily fine weather during the summer months and by the general railway strike in August last. The London United Tramways not only shows an increase in gross receipts, but a very substantial decrease in working expenses. The Lot's Road power house undertaking became vested in the Lot's Road Power House Joint Committee as from January 1st, 1912, and was thereupon leased by the Joint Committee to the Metropolitan District and London Electric Railway Companies. The property has therefore become part of the undertakings of those companies.

The Metropolitan District Railway Co. has paid in respect of the last half-year a dividend at the rate of 2 per cent. per annum on its 5 per cent. second preference stock. The company owns the whole of this stock, and for the first time secures a return on this investment. The widening of the London and South-Western and the Metropolitan District Railways between Studland Road and Acton Lane Junction was practically completed and opened for traffic on December 3rd last. The improvement gives to the District Railway Co. the exclusive use of a separate pair of rails between those points and relieves the company's working from interference by the London and South-Western trains, and also enables the company to work a more frequent and faster service of trains to the rapidly growing districts served by the Western Extensions. To provide for the additional service, the District Railway Co. has purchased 66 new carriages.

Contracts for the construction of the Paddington and Charing Cross extensions (London Electric Railway Co.) have been entered into, and the work is proceeding satisfactorily.

An escalator (or moving stairway) has been installed at the Earl's Court Station for the convenience of the interchange traffic between the Great Northern, Piccadilly & Brompton and the Metropolitan District Railways at that point. It was opened for public use on October 4th last, and has proved a very popular and convenient means of interchange between the two railways. Its success has justified the company in approving the installation of escalators instead of lifts at other stations.

The report proceeds to set forth the main provisions of its Parliamentary Bills, namely, Metropolitan District Railway Co.'s Bill, London Electric Railway Co.'s Bill, the Edgware and Hampstead Railway Co.'s Bill, and the London United Tramways, Ltd., Bill.

In regard to the London General Omnibus Co., the board of the Underground Co. has, with the concurrence of the board of the L.G.O. Co., formulated a scheme with a view to fusing the interests of the two companies.

A copy of the scheme was sent to all the shareholders on January 19th. It is proposed that if the holders of 75 per cent. (or such less proportion as the boards of the two companies may agree) of the ordinary stock of the London General Omnibus Co. accept the offer thereby made, the Underground Co. will create and issue to such stockholders in exchange for each £100 of their ordinary stock, and so on in proportion for larger or smaller amounts:—

(a) £105 of 6 per cent. first cumulative income debenture stock, carrying interest as from January 1st, 1912.

(b) £105 of 6 per cent. income bonds to rank *pari passu* with the present income bonds, and carrying interest as from January 1st, 1912.

(c) 100 "A" ordinary shares of 1s. each (part of a proposed issue of 1,200,696 like shares).

In addition, the ordinary stockholders of the L.G.O. Co. will receive from that company a cash bonus of £8 per cent. in respect of accumulated profits to December 31st, 1911.

The first cumulative income debenture stock will be secured as to capital by a first charge on such of the ordinary stock of the London General Omnibus Co. as is taken over by the company, and will rank for interest after the 4½ per cent. bonds of 1933, and before the 6 per cent. income bonds.

The 1,200,696 "A" ordinary shares will be entitled to divide between them one-third of the profits available for dividend.

In order to make the scheme effective, both companies have to amend their articles of association, and carry out certain other formalities, and all necessary steps are being taken for this purpose.

The item of stocks, shares and other property stands in the books at £10,988,686, and consists of stocks and shares in associated companies, consols and lands and buildings other than power-house property. The decrease of £1,003,232 in the figure shown in the balance sheet, as compared with the corresponding figure at June 30th, 1911 (£11,991,918), mainly results from the sale of £1,285,000 London Electric Railway preference stock.

Imperial Tramways Co., Ltd.

The directors' report to December 31st last has been issued together with the details of the revenue accounts of the subsidiary undertakings.

Middlesbrough, Stockton and Thornaby Electric Tramways.—The gross receipts from this undertaking amount to £56,686, as compared with £51,922 for the preceding year, an increase of £4,763. The total number of passengers carried was 11,221,628, against 10,276,749, an increase of 944,879. The net profit for the year is £13,305, as compared with £16,303 for the corresponding period. The net profit would have shown an increase compared with last year's amount, but for the fact that during the year a considerable portion of the track has been reconstructed and the outlay charged against the revenue for the year. The traffic receipts again show an improvement, having reached the highest amount in the history of the undertaking. The company's Bill of last session, as altered by Parliament, received the Royal Assent on August 18th.

Corris Railway Co.—The working of this undertaking shows an increase in net profit of £24. There has been an increase in receipts of £380, largely due to the running of motor coaches for the summer holiday traffic instead of horse coaches as hitherto. It is intended to develop this traffic to a larger extent in the ensuing season.

London United Tramways, Ltd.—The report and accounts of this undertaking show that the results for the past year again mark considerable improvement. The receipts have increased by £10,328, and the net revenue by £25,506, the available balance of net revenue after payment of fixed charges amounting to no less than £56,432. The directors of the L.U. Co. state that the revenue would have sufficed for a dividend distribution on the preference shares, but they considered that in the company's best interests it was advisable for this year to strengthen the reserves by appropriating the sum of £30,000 to a general reserve. Of the remaining balance £25,000 is added to the reserve for renewals and contingencies, this reserve fund now amounting to £76,033, and the general reserve to £30,000. The accumulated arrears of the Imperial Co.'s holding of 44,446 preference shares in the L.U. Co. now amount to 16½ per cent., and represent a total of £72,224.

The directors observe with pleasure that the position of the L.U. Co. has so substantially improved during the past year, and they are hopeful that the board of that company will see their way to resume payment of the preference dividend at an early date. In the meantime the non-receipt of dividend from that undertaking precludes the directors from recommending payment of any dividend on the preference and ordinary shares of this company. The revenue account for the year shows an available amount of £13,001, and after payment of the interest on debenture stock for the whole year, amounting to £12,712, there is a balance (including £7,390 brought forward from last account) of £7,678, which the directors recommend should be carried forward.

Paisley District Tramways Co.

The directors' report for the half-year ended December 31st, 1911, shows that the revenue was £28,933, the expenses being £15,828, leaving £13,105, less general interest £96, interest on debentures £1,600, debenture sinking fund £750, leaving £10,660, to which are added £1,441 brought forward and £375 "recovery on amount paid for electrical energy last year." There is thus a balance of £12,475, out of which £2,750 has been placed to general reserve account, and the balance is to be disposed of as follows: £3,750 to dividend at the rate of 5 per cent. per annum on £150,000 cumulative preference shares for the half-year; £1,000 to preference share sinking fund; £2,416 to dividend at the rate of 3 per cent. per annum on the ordinary shares for the half-year; £2,559 to be carried forward. The traffic receipts show an increase of £3,963 and the expenses an increase of £1,608. The increase in receipts is mainly due to the extension from Barrhead to Rouken Glen, which was not in operation during the corresponding half-year of 1910. The whole of the extensions having been completed, at the request and expense of the contractors, £150,000 5 per cent. cumulative preference shares and £80,000 4 per cent. debentures were offered on their behalf for public subscription in October last, and were duly allotted. £155,800 ordinary shares, credited as fully paid, were also allotted to the contractors in accordance with their contract for the construction work.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts	Average fare.	Car-mileage.	No. o cars.
June, 1910	.. 14·69	5,489,550	£23,052	1·02	473,556	50
Dec., „	.. 14·69	5,756,773	£24,778	1·03	511,731	50
June, 1911	.. 17·98	6,109,072	£26,121	1·04	559,021	56
Dec., „	.. 17·98	6,487,033	£28,736	1 06	608,502	56

Pennsylvania Water and Power Co.—The directors' report states that the total revenue from all sources for the year 1911 amounts to $516,285, and the interest charges, expense of operation and maintenance to $450,084, leaving a surplus of $66,200. While large contracts for the delivery of power to the United Railways and Electric Co. and the Consolidated Gas, Electric Light and Power Co., of Baltimore, were concluded early in the year, the company did not receive the full benefit of these contracts until July last. This, of course, had a marked influence on the total income for the year, and will be best realised by the statement that the income from power for the last six months of the year was double that between January 1st and July 1st. At the close of the fiscal year (says the *Financier*) the company was in receipt of income at a rate in excess of $600,000 per year. The present income is derived from contracts of a nature which employ at times very nearly the present capacity of the plant. With a varying water supply, it is necessary for this company to make contracts which provide large capacity for limited periods of time. By reason of this fact, the directors propose to extend the capacity of the plant by installing during 1912 an additional unit to water-wheel and generator capacity. This will increase the present electrical capacity by 16,000 H.P., giving at the end of 1912 an installed electrical capacity of 72,667 H.P. This increased capacity will permit the making of further contracts for the delivery of power. During the year there has been issued $350,000 of bonds on account of construction work. Of this amount $100,000 have been taken down from the trustee and sold, the balance being held for the purpose of covering the cost of the proposed extension of plant during 1912.

Harper Electric Piano (1910) Co., Ltd.—The directors have declared a dividend for the half-year to December 1st at the rate of 2½ per cent. per annum.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, February 14th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Ferro-Silicon (50 %) (basis 45 %)	,,	£12 12 6	..
a Copper Sulphate	,,	£22	£1 10 dec.
a Lead, Nitrate	,,	£25	..
a ,, White Sugar	,,	£22 15	..
a ,, Peroxide	,,	£32	..
c Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (80/82 %)	per ton	£20 5	..
a ,, Chlorate	per lb.	8½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %)	,,	7½d.	..
a Shellac	per cwt.	68/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
a ,, Cyanide { (128/130 %) (basis 100 %) }	,,	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£65	..
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7½d.	..
c ,, Tube (brazed)	,,	9½d.	¼d. dec.
c ,, ,, (solid drawn)	,,	8d.	¼d. dec.
c ,, Wire, basis	,,	7½d.	..
c Copper Tubes (brazed)	,,	10¾d.	¼d. dec.
c ,, ,, (solid drawn)	,,	9¾d.	¼d. dec.
g ,, Bars (best selected)	per ton	£79	£2 inc.
g ,, Sheet	,,	£79	£2 inc.
g ,, Rod	,,	£79	£2 inc.
d ,, (Electrolytic) Bars	,,	£66 5	15s. inc.
d ,, ,, Sheets	,,	£83 5	15s. inc.
d ,, ,, Rods	,,	£71 5	15s. inc.
d ,, ,, H.C. Wire	per lb.	8⅝d.	1/16d. inc.
f Ebonite Rod	,,	5/8	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	4/7½	½d. inc.
j Iron Pig (Cleveland warrants)	per ton	48/10½	3¾d. dec.
j ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£16 to £16 2 6	5/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 7 6	2/6 inc.
e Mica (in original cases) small	per lb.	6d. to 2s.	..
e ,, ,, ,, medium	,,	2/6 to 4/-	..
e ,, ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, ,, rolled bars & rods	,,	1/0½	..
p ,, ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	9½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£199 to £200	£3 inc.
n ,, Wire, Nos. 1 to 16	per lb.	2/4	..
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£30 7 6	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
j Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

Telegraph Construction and Maintenance Co., Ltd.—The directors have declared a dividend of 10 per cent. (£1 4s.) per share, together with a bonus of 2½ per cent. (6s. per share), in addition to the 5 per cent. already paid, making 17½ per cent. for the year 1911. For 1910 the total distribution was 20 per cent.

STOCKS AND SHARES

Tuesday Evening.

It must be frankly acknowledged that there is nothing very interesting to say about the Stock Exchange markets this week. Noticeable features are advances in Reuter's shares, British Westinghouse Preference and Marconis; but, speaking generally, the electrical sections are quiet, with a good deal of firmness on the whole, and nothing very exciting either to read or to write about.

Anxiety dogs the Home Railway position with respect to the outlook in the coal trade, but the market received a sharp fillip from the substantial rise in Consols, due to political rumours. Tube issues are holding their recent improvements, with the exception of Districts, which have fallen ¾, while Underground Electric Income bonds shed 2. These falls are said to have been caused by the fact that the absorption of the London General Omnibus Company by the Underground Electric may be regarded as an accomplished fact, and a slight reaction of sentiment has caused holders of Districts and Underground Incomes to inquire whether the fusion is, after all, going to benefit them to the extent supposed at first.

It may be of some interest to mention that London Electric Railway 4 per cent. Preference stock can now be bought at 83½, this price carrying the dividend of 2 per cent. payable at once, so that a purchaser to-day will get all but 5 per cent. on his money from the investment.

London United Tramways 4 per cent. Debenture fell 2, and the market did not fail to observe the statements made at last week's meeting of London and South-Western Railway proprietors as to the proposals for electrifying part of the company's suburban system. Metropolitan Electric Tramways Deferred eased off to 3s. There is a certain amount of business doing in British Electric Tractions, and the 6 per cent. cumulative Preferred rose 3 points. South Metropolitan Trams 4 per cent. Debenture at 74½ is 2 higher.

Dividend announcements—some already made and others imminent—hold the market for Electricity Supply shares very firm. City "Lights" are ¾ higher, and the other gains of last week have been retained. Edmundsons' Preference are 5s. better, following upon their previous gain of 7s. 6d., and Urban Preference also put on 5s., the two prices being 3 and 2⅞ respectively, comparing with 2⅞ and 2¼ a fortnight ago. It is fully expected that the Urban Company will now go ahead, and if so, of course, the parent will be substantially advantaged. South Metropolitan 4½ per cent. Debenture stock, with a rise of a point, is the only one of its kind to show quotable alteration this week.

Securities connected with Mexican companies are all upset by the latest reports as to the revolution in that distressful country. The news at present is certainly not conducive to restful nights for those who have money invested in Mexico. But the authorities whom we have consulted do not seem to take a very gloomy view of the situation, arguing that the present trouble will blow over just the same as similar difficulties have done in the past. Meanwhile, however, Mexican Light and Power shares are down 2½, the Preference 1 and Mexico Trams 1; while the bonds have suffered to a smaller extent. The whole department is somewhat affected by the cloud over Mexicans, and Sao Paulo Trams fell 2. La Plata Ordinary are ⅛ easier at 14s. Manaos Debenture rose ¼ to 93. There are slight improvements in Para Electric Ordinary and Rio bonds. A jump of 2½ in River Plate Preference raised the price to 112½. Shawinigan Water shed 2½, while Kaministiquia bonds are a point higher. Electrical Developments of Ontario have come into further demand, and are 1½ up, while Calgary Power bonds are 1 lower on the week. Brisbane Trams Ordinary recovered part of their fall, and British Columbia Electric stocks are all firm, the 5 per cent. Preference being slightly higher. The recent rises in Kalgoorlie Electric Power have brought in sellers, with the result that both Ordinary and Preference are a trifle down.

Marconis are the most volatile share in the Stock Exchange at the present time. The price, on the whole, has been steadily good, touching 4½ on Tuesday morning, in spite of the fact that the carry-over rate of 8 per cent. evidenced the continued existence of a big "bull" account. Men in the market talk with confidence of the shares going higher. Telegraph stocks are mostly steady and rather uninteresting. West India and Panama keep about 4½, speculation having died out to a very large degree, and though hints are persistently circulated as to the probability of the company being bought out by one of the American syndicates at work in connection with Panama matters.

National Telephone Deferred has given way, and the market estimates of what the stock is likely to be repaid at, are being framed on lines a good deal more modest than those which prevailed a month or two ago. The latest guess which we have heard in the Stock Exchange is that holders will get some price nearer 130 than 120. Monte-Video Ordinary and Oriental Ordinary have both improved, while a few Telephone bonds are also better. A remarkable feature is a further rise of 27s. 6d. in the price of Reuters. Three rumours are afloat to account for this. One says that part of the reserve will be capitalised and shares distributed as a bonus. The second reports that such a distribution will take the shape of hard cash, and the third is to the effect that the dividend will be largely increased.

In the Manufacturing division there has been a tip round to buy British Westinghouse Preference, and the price mounted to 15s., easing off to 12s. 6d. afterwards. What the tip was on we have been unable to discover. Telegraph Constructions are better, and Babcock rose ⅛. Rubber shares, after experiencing dullness and depression, firmed up again on the results of the Mincing Lane sales this week.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for		Closing Quotations Feb. 13th.	Rise + or Fall —	Present Yield p.c.
	*	1910.	1911.			£ s. d.
Bournemouth & Poole, Ord.	10	5½	5†	8 — 9	..	6 2 3
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅞	..	4 12 4
Do. Second 6 % Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	10 — 102	..	4 8 3
Brompton & Kensington, Ord.	5	10	9†	8 — 8½	..	5 17 8
Do. 7 % Cum. Pref.	5	7	7	7½ — 8	..	4 7 6
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 —101	..	3 19 3
Charing Cross, West End & City	5	5	5†	3⅞ — 4⅛	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4¼	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 9 1
Do. Do. 4 % Deb.	100	4	4	93 — 96	..	4 3 4
Chelsea, Ord.	5	5	4†	4⅛ — 4⅜	..	5 8 1
Do. 4½ % Deb.	Stock	4½	4½	98 —101	..	4 9 1
City of London, Ord.	10	7	6†	13½ — 14	+ ⅜	5 0 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13	..	4 12 4
Do. 5 % Deb.	Stock	5	5	117 —121	..	4 2 8
Do. 4½ % Second Deb.	100	4½	4½	100 —103	..	4 7 5
County of Durham, 5 % First Mort. Deb.	Stock	5	5	87 — 89	..	5 12 4
County of London, Ord.	10	5	4†	9⅛ — 9⅜	..	5 8 11
Do. 6 % Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	Stock	4½	4½	107 —109	..	4 2 7
Do. 4½ % Second Deb.	Stock	4½	4½	100 —103	..	4 7 5
Edmundson's, Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	2⅜ — 3½	+ ½	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	87 — 90	..	5 0 0
Folkestone	5	6	6†	4½ — 5	..	6 0 0
Do. 5 % Cum. Pref.	5	5	5	4⅝ — 5½	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	93 — 96 xd	..	4 13 9
Hove	5	9	8†	6⅞ — 7½	..	6 4 2
Kensington & Knightsbridge, Ord	5	9	8†	6⅞ — 7½	..	6 4 2
Do. 4 % Deb.	Stock	4	4	92 — 95 xd	..	4 4 3
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	78 — 82	..	5 9 9
London Electric, Ord.	3	2	..	1⅜ — 1⅝	..	3 12 0
Do. 6 % Pref.	5	6	6	4⅜ — 5	..	6 0 0
Do. 4 % First Mort. Deb.	Stock	4	4	88 — 91	..	4 8 0
Metropolitan	5	5	4†	3⅞ — 4⅛	..	5 17 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	99 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	95 — 97	..	4 12 9
Newcastle-on-Tyne	5	4	4†	3⅞ — 4	..	5 0 0
Do. 5 % Pref., Non-Cum.	5	5	5	4 — 4⅛	..	5 11 1
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99 —102	..	4 18 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	..	9⅜ — 10⅜	..	..
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 5
St. James' and Pall Mall, Ord.	5	10	10†	8⅜ — 8⅝	..	5 16 0
Do. 7 % Pref.	5	7	7	6⅜ — 7⅛	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	2	1⅜ — 1⅝	..	Nil
South London, Ord.	4	5	5	2⅜ — 3⅝	..	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	98 —101	..	4 19 0
South Metropolitan, 7 % Pref.	1	7	7	1 — 1⅛	..	6 4 5
Do. 4½ % First Deb. Stock	100	4½	4½	97 —100	+1	4 10 0
Urban, Ord.	5	5	..	⅛ — ¼	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 3½	+ ½	..
Do. 4½ % First Mort. Deb.	100	4½	4½	88 — 90	..	5 0 0
Westminster, Ord.	5	10	10†	8½ — 8⅝	..	5 16 0
Do. 4½ % Cum. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 6 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅞ — 6	..	5 0 0
Calcutta, Ord.	5	8⅓	7†	6⅛ — 6⅜	..	6 6 0
Do. 5 % Pref.	5	5	5	5 — 5⅛	+ ⅛	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	92½ — 94½	— ½	5 5 8
Canadian Gen. El. Com.	$100	7	7†	118 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	117 —121	..	5 15 8
Cordoba Lt., Power and T., Ord.	1	3	3†	⅞ — 1	..	3 0 0
Do. 5 % Deb.	100	5	..	95 — 98	+1	5 2 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	91 — 93	..	6 9 0
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	94 — 96	+1½	5 4 2
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	⅜ — ½	..	Nil
Do. 6 % Pref.	1	6	6	⅞ — 1	+ 1/16	8 0 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	+1	4 15 3
Madras, Ord.	5	..	..	2⅜ — 3⅛	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —103	..	4 17 1
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	85½ — 87½	—1	5 14 3
Mexican Lt. & Power, Common	$100	4	4†	85 — 87	—2½	4 12 0
Do. 7 % Cum. Pref.	$100	7	7	106½ —108½	—1	6 9 0
Do. 5 % 1st Mort. Gold Bds.	..	5	5	95 — 97 xd	..	5 3 1
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	89½ — 91½	..	5 9 3
Montreal, Lt., H. and Power	$100	7	8	193 —198 xd	..	3 9 4
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 2 10
River Plate, Ord.	Stock	10	..	250 —260	..	3 16 11
Do. 6 % Non-Cum. Pref.	Do.	6	6	110 —115	+2½	5 4 4
Do. 5 % Deb. Stock	Do.	5	5	100½ —102½	..	4 17 7
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	100 —102	..	4 8 3
Shawinigan Water, Capital	$100	4	6†	125½ —127½	—2½	3 18 5
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	107 —109	..	4 11 9
Do. 4½ % Per. Deb.	Stock	4½	4½	103 —105	..	4 5 9
Toronto Power, 4½ % Deb.	Do.	4½	4½	99½ —101½	..	4 8 8
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 1
Victoria Falls Power, Pref.	1	Nil	11¼d.	1/16 — 1/8	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	107 —109	+ ½	5 10 1

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7¼ — 7⅝	..	..
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	..	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	142½ —144½	+1	5 10 9
Do. Collat. Trust	$1000	4	4	93 — 95	..	4 4 3
Anglo-American Telegraph	Stock	8¾	8	66 — 68 xd	+ ⅛	4 8 6
Do. 6 % Pref.	Do.	6	6	109⅜ —110⅜ xd	..	5 8 4
Do. Def.	Do.	80/-	80/-	25⅛ — 25⅞ xd	— ⅛	5 16 6
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	+ ⅜	4 16 1
Chili Telephone	5	7	..	7⅛ — 7⅜	..	4 13 4
Commercial Cable, Stlg. 4% Deb.	Stock	4	4	86 — 88	..	4 10 11
Cuba Telegraph	10	6	6†	10⅛ — 11⅛	..	5 6 8
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3⅛ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	8 — 8½	..	5 17 8
Do. 4½ % Debs.	50	4½	4½	99 —101	+ ½	4 9 1
Direct United States Cable	10	4½	..	7⅜ — 8 xd	— ⅛	5 12 6
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	186 —189	..	5 0 9
Do. 3½ % Pref. Stock	Do.	3½	3½	83 — 85	..	4 2 4
Do. 4 % Mort. Deb.	Do.	4	4	100 —102	..	3 18 5
Eastern Extension	10	7	5†	18⅛ — 18⅞	..	5 1 10
Do. 4 % Deb.	Stock	4	4	99 —101 xd	..	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	99 —102	..	3 19 3
Globe Telegraph and Trust	10	5⅞	6†	11 — 11½	+ ⅛	5 2 2
Do. 6 % Pref.	10	6	6	13⅛ — 13⅝	+ ⅛	4 8 1
Great Northern Telegraph	10	18	5†	84 — 88	..	5 9 1
Indo-European Telegraph	25	18	5†	56½ — 58½	..	5 10 2
Mackay Companies Common	$100	5	5†	80 — 82	+2½	6 2 0
Do. 4 % Cum. Pref.	$100	4	4	70 — 72	..	5 11 1
Marconi's Wireless Telegraph	1	5	..	4⅛ — 4⅜	+ ⅛	..
Do. 7 % Cum. Partic. Pref.	1	16	..	3⅛ — 3⅜	+ 1/16	..
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛	+ 1/16	5 6 8
Do. 5 % Pref.	1	5	5	1⅜ — 1⅝	..	5 6 8
National Telephone, Pref.	Stock	6	6†	99½ —102½	..	5 17 1
Do. Def.	Do.	6	6†	120 —122	—2½	4 18 4
Do. 6 % Cum. 1st Pref.	10	6	6	9⅛ — 10	..	6 0 0
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅛ — 10	..	6 0 0
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5 1/16 — 5 3/16	— 1/16	4 12 0
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	103 —104	+ ⅛	4 6 6
Oriental Telep. and Elec.	1	8	..	1⅜ — 1⅝	+ 1/16	4 14 10
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜	..	4 18 8
Do. 4 % Red. Deb.	Stock	4	4	87⅛ — 89½	..	4 9 5
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	98⅜ —100⅝	..	3 19 7
Reuter's	8	5	5†	10½ — 11	+1⅛	3 12 9
Submarine Cables Trust	Cert.	6	6	180 —183	..	4 10 8
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	+ ½	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7⅝	..	5 4 11
Do. 5 % Cum. Pref.	5	5	5	5⅜ — 5⅝	..	4 8 11
West Coast of America	2½	2½	2½	1⅛ — 1⅜	..	3 11 5
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	— ½	4 0 0
West India and Panama Teleg.	10	1½	1½†	4⅛ — 4½	— ⅛	..
Do. 6 % Cum. 1st Pref.	10	6	6	10⅞ — 11⅞	+ ⅛	5 7 10
Do. 6 % Cum. 2nd Pref.	10	6	6	9⅝ — 10⅝	..	5 6 8
Do. 5 % Debs.	100	5	5	102 —104	..	4 16 2
Western Telegraph, Ltd.	10	7	6†	13½ — 14	..	5 0 0
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Western Union Tel., 4% Bnds. A	$1000	4	4	106 —109	..	3 13 5
Do. 4½ % Fdg. Bonds	$1000	4½	4½	101 —104	..	4 6 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Feb. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	* 1	Nil	Nil	⅞ — 1	.	Nil
Do. 5 % Pref.	1	5	5	7/8 — 1 1/8	..	7 5 6
Do. 4½ % Deb.	100	4½	4½	80 — 85	..	5 5 11
Brit. Elec. Trac., 6 % Pref.	100	..	..	14 — 18	..	..
Do. Do. Deferred	100	..	..	6 — 9	..	..
Do. Do. 6 % Cum. Pr'f.	100	..	..	90 — 92	+3	..
Do. 7 % Non-Cum. Pr'f.	100	..	..	37 — 40	..	..
Do. 5 % Perp. Deb.	100	5	5	96 — 99	..	5 1 0
Do. 4½ % 2nd Deb.	100	4½	4½	79 — 83	..	5 8 5
Central London Railway, Ord.	100	8	8†	72 — 74	..	4 1 1
Do. Pref.	100	4	4	85 — 87	..	4 12 0
Do. Def.	100	2	..	62 — 64	..	3 2 6
Do. 4 % Deb.	100	4	4	100 —102	..	3 18 5
City & South London, Ord.	100	1½	1½†	28 — 29 xd	..	5 12 1
Do. 5 % Pref., 1891	100	5	5	106 —108 xd	..	4 12 7
Do. Do. 1896	100	5	5	102 —104 xd	..	4 16 2
Do. Do. 1901	100	5	5	101 —103 xd	..	4 17 1
Do. Do. 1908	100	5	5	101 —103 xd	..	4 17 1
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
Dublin United Trams, 6 % Pref.	10	6	6	11 — 12	..	5 0 0
Great Northern & City, Pr'f. Ord	10	Nil	..	1⅛ — 1⅜	..	Nil
Hastings Trams, 6 % Pref.	5	Nil	3†	⅛ — ¼	..	..
Do. 4½ % Deb.	100	4½	4½	73 — 78	..	5 15 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅜ — 2½	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	80 — 82	..	6 2 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	3⅜ — 4⅛	..	..
Do. 4 % Deb.	100	4	4	75 — 78	—2	5 2 7

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations Feb. 13th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	* 100	1⅜	1⅜†	47⅜ — 48½	+ ¼	3 17 9
Do. Surplus Lands	100	2⅜	2⅝†	68 — 70	+1	3 18 7
Do. 5½ % Deb.	100	5½	5½	90 — 92	..	3 16 1
Do. 5½ % Pref.	100	5½	5½	86 — 88	..	3 19 7
Do. 5½ % Con. Pref.	100	5½	5½	85 — 87	..	4 0 6
Metropolitan District Ord.	100	Nil	..	34 — 34½	— ⅜	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	95 — 97	..	4 2 6
Do. 4 % Prior Lien	100	4	4	100 —102	..	3 18 5
Do. 4½ % First Pref.	100	3½	4½†	91 — 93	..	3 10 0
Do. 5½ % Gtd.	100	5½	5½	75 — 77 xd	..	4 10 11
Metropolitan Elec. Trams, Ord.	1	5½	5†	3⅞ — 4⅛	..	5 13 6
Do. Def.	1	Nil	..	1/16 — 3/16	— 1/32	Nil
Do. 5 % Pref.	1	5	5	29/32 — 31/32 xd	..	5 10 2
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	100½—102½	..	4 17 7
Potteries, Ord.	1	2	..	3/32 — 5/32	..	..
Do. 5 % Pref.	1	5	5	15/16 — 31/32	..	6 19 8
Do. 4½ % Deb.	100	4½	4½	90 — 93	..	4 16 9
South Metro. Trams, 6 % Pref.	1	6	..	3/8 — 5/8	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	+2	5 4 0
Underground Elec. Railways	10	..	..	2⅜ — 2⅝	..	..
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1½†	76 — 78	—2	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	5	Nil	..	2/16 — 3/16	..	Nil
Do. 4½ % Deb.	100	4½	4½	81 — 85	..	5 5 11

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5⅛ — 5⅜	..	5 2 4
Do. 2nd Pref.	5	5	5½	4 13/16 — 5 1/16	..	5 3 6
Do. 4 % Deb.	100	4	4	94 — 96½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	101 —103	..	4 7 5
Do. 5 % Deb.	100	5	5	102 —104	..	4 16 7
Auckland Trams, 5 % Deb.	100	5	5	102 —105	..	4 15 3
Bombay Elec. S. & Trams, Pref.	10	6	6	10⅜— 11⅛ xd	..	5 7 10
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	98 —100	..	5 0 0
Brisbane Trams Invt., Ord.	5	8	8†	8⅝ — 9	+ ¼	4 8 11
Do. 5 % Pref.	5	5	5	4⅝ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	136 —141	..	5 13 0
Do. Pref. Ord.	100	6	6	119 —122 xd	..	4 18 4
Do. 5 % Pref.	100	5	5	108 —111	+ ½	4 10 1
Do. 4½ % 1st Mort. Deb.	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 4½ % Con. Deb.	100	4½	4½	101 —103	..	4 7 5
Calcutta Trams, Ord.	5	6	..	5⅛ — 5⅜	..	5 4 4
Do. 5 % Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
Cape Electric Trams	1	Nil	2½†	13/16 — 15/16	..	..
City Buenos Aires Trams (1904)	5	5	5	5⅛ — 5⅜	..	4 5 1
Do. 4 % Deb.	100	5	5	95 — 98	..	5 2 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	93 — 98	..	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	100 —103	..	4 17 1
Kalgoorlie Elec. Trams	1	Nil	..	3/16 — 5/16	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	58 — 62	..	8 1 4

La Plata Elec. Trms, Ord.	1	..	..	31/32 — 1 1/32	— 1/32	..
Do. Pref.	1	6	6	31/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1¼	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	93½ — 97½	..	5 2 7
Madras Elec. Tr. (1904), Deb.	100	5	5	93½ — 96½	..	5 3 8
Manaos Trams & Lt., 1st Deb.	100	5	5	92 — 94	+ ½	5 6 5
Manila Elec. R. and Ltg., Bonds	$1000	5	5	101 —103	..	4 17 1
Mexico Trams Com.	$100	7	7†	121 —123	—1	5 13 10
Do. Gen. Con. 5 % Bonds	..	5	5	101 —103	..	4 17 1
Do. 6 % Bonds	100	6	6	101 —103	..	5 16 6
Para Elec. Rlys. & Lt., Ord.	5	10	10†	7 5/16 — 7 7/16	— 1/16	6 12 3
Do. 6 % Pref.	5	6	6	5 — 5½	..	5 9 1
Do. 5 % 1st Deb.	100	5	5	97½ — 99½	..	5 0 6
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1⅜ — 1⅝	..	1 15 7
Do. 5 % 1st. Deb.	100	5	5	99 —101	..	4 19 0
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅝ — 5⅞	..	5 2 2
Do. 4½ % 1st Deb.	100	4½	4½	98 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	115 —116	..	4 6 2
Do. 1st Mort. 5 % Bonds	..	5	5	101½—102½	..	4 17 10
Do. 5 % Mort. Bonds	100	5	5	98½ — 99½	+ ½	5 0 9
Sao Paulo Tram, Lt. and P.	$100	10	10†	195 —197	—2	5 1 6
Do. 5 % 1st Deb.	$500	5	5	102 —104	..	4 16 2
Singapore Trams, 5 % Deb.	100	5	5	81 — 84	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95 xd	..	5 5 3
Un. Elec. Trams Monte Video	5	6	7	5 — 5½	..	5 9 1
Do. 6 % Pref.	5	6	6	5⅜ — 5⅝	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98½ —101½	..	4 18 6
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	104 —106	..	4 4 11

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/8 — 5/8	..	..
Do. 6 % Pref.	1	9	6	3/4 — 7/8	..	7 2 2
Babcock & Wilcox	1	26	24†	6 5/8 — 6 3/4	+ 1/16	3 19 0
Do. Pref.	1	6	6	1⅛ — 1⅜	..	3 13 10
B.I. & Helsby Cables	5	10	8†	6⅝ — 7⅛	..	7 0 4
Do. Pref.	5	6	6	5⅞ — 6¼ xd	..	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	94 — 97	..	4 12 9
British Westinghouse, Pref.	* 3	Nil	..	1/2 — 3/4	+ 1/16	Nil
Do. Deb.	100	4	4	57 — 60	+2	6 13 4
Do. 6 % Prior Lien	100	6	6	102 —105	+1	5 14 3
Browett, Lindley, Ord.	1	Nil	..	1/6 — 2/-	..	Nil
Do. Pref.	1	Nil	..	5/- — 6/-	..	Nil
Brush, Ord.	2	Nil	..	0 — 1/2	..	Nil
Do. 7 % Pref.	2	Nil	..	0 — 1/2	..	Nil
Do. 4½ % Deb.	100	4½	4½	56 — 61	..	7 7 7
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	9 — 9½	..	7 18 10
Do. Pref.	5	5	5	5 — 5½	..	4 15 3
Do. Deb.	100	4½	4½	98½ —100½	+ ½	4 9 7
Castner-Kellner	1	17½	20	34⅛ — 34⅜	..	4 11 10
Do. Deb.	100	4½	4½	106 —110 xd	..	4 1 10
Crompton & Co.	8	Nil	Nil	⅛ — ¼	..	Nil
Do. Deb.	100	5	5	58 — 68	..	7 7 1

Dick, Kerr	1	5	..	3⅞ — 3¼	..	5 3 1
Do. Pref.	1	6	6	1⅛ — 1 3/16	..	5 12 11
Do. Deb.	100	4½	4½	98 —101	+ 5/16	4 9 1
Edison & Swan, A, £3 paid	5	Nil	..	1/16 — 1/8	— 1/16	Nil
Do. fully paid	5	Nil	..	1⅜ — 2⅜	..	Nil
Do. 4 % Deb.	100	4	4	71 — 75	..	6 6 8
Do. 5 % Second Deb.	100	5	5	77 — 80	..	6 5 0
Electric Construction	2	Nil	2½†	3/4 — 1	..	..
Do. Pref.	2	7	7	1⅜ — 1⅝ xd	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7¼ — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9½	..	5 5 3
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11⅜ — 12½	..	6 2 5
Do. Pref.	5	4½	4½	4⅛ — 5⅛	..	4 5 11
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	..	10 — 12	..	..
Do. Pref.	10	5	5	9⅜ — 10⅜	..	4 17 7
Telegraph Construction	12	20	10†	35½ — 37½	+ ½	6 7 0
Do. Deb.	100	4	4	99½—101½	..	3 18 10
Willans & Robinson	1	Nil	..	1/16 — 3/16	+ 1/16	Nil
Do. Pref.	5	Nil	..	1 — 1½	+ ½	Nil
Do. Deb.	100	4	4	53 — 58	+1	6 18 0

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

The yields are calculated in most cases upon the dividends paid for 1910.

Bank rate of Discount 3½ per cent., February 8th, 1912.

OPAL SHADES.

[COMMUNICATED.]

The virtues of scientifically-designed shades with prism angles calculated in the laboratory have been dinned into the ears of the electrical world until we are apt to accept without question the claim that such expensive wares are essential to efficient lighting. We are in danger of forgetting the good qualities of the cheap, homely, old-fashioned opal, or, at the best, are unable to support our opinion of its excellence by convincing figures.

The following tables, therefore, may be of service in showing the actual state of affairs. The readings give the foot-candles of illumination on a standard surface at a distance of 5 ft., and each result represents the average of a number of readings.

The shades used were ordinary conical white-opal ones, and it will be noticed that the shallower one cuts off some of the horizontal rays in the case of the short carbon lamp only, whereas the deeper one practically obscures both lamps.

The introduction of long metallic filaments accentuated the difference between the vertical and horizontal candle-powers of incandescents: in the cases before us it will be seen the increase is from less than 2 to 1 to more than 4 to 1, so that, if light is required principally in a downward direction, the lamp must either be fixed on its side (to the detriment of the filament life) or a good reflecting shade must be employed. From the tables it is evident that, by using a suitable shade, the vertical illumination may be increased five times in the case of the carbon and nine times in the case of the metal-filament lamp. At the angle of 45°, the former is double, the latter half as much again.

16-C.P. 100-VOLT CARBON-FILAMENT LAMP.

	Bare.	10 *in.* × 3 *in. shade.*	10½ *in.* × 5½ *in. shade.*
Vertical ...	0·35	1·44	1·92
30°	0·48	1·22	1·42
45°	0·58	1·04	1·13
60°	0·58	1·00	0·84
Horizontal ...	0·65	0·50	0·18

50-C.P. 100-VOLT METAL-FILAMENT LAMP.

	Bare.	10 *in.* × 3 *in. shade.*	10½ *in.* × 5½ *in. shade.*
Vertical ...	0·47	2·71	4·15
30°	1·23	2·32	3·00
45°	1·62	2·32	2·83
60°	1·82	2·30	2·56
Horizontal ...	1·96	1·96	0·40

No doubt good results could be obtained by utilising the direct horizontal rays aided by a reflector of the shell type. Such a shade could not be produced cheaply in opal, and the silvered troughs usually supplied are likewise rather expensive. A metal trough painted white (but a by no means dazzling white) inside gave readings of 1·4 foot-candles with the 16-C.P. lamp and 3·2 with the 50-C.P. metal one.

On the whole, it seems the old conical opal shade serves its purpose well, and the contention of a recent writer, who advocated presenting the filament broadside on to the object to be lighted because "you can't shoot light out of a funnel like shot out of a gun" is scarcely accurate.

Memorial to Prof. Ashcroft.—On December 14th, 1911, the sudden death occurred of Prof. Ashcroft, assistant professor of civil and mechanical engineering at the Central Technical College. Prof. Ashcroft was so universally liked by all those who came in contact with him at the college, and he did so much to help his students both in and out of college hours, that there is a very strong feeling that his old students should unite to found a memorial to his name and work. After careful investigation by the Old Students' Association, it is considered that the most suitable plan to adopt is to place a tablet to his memory in the college, and to collect funds for the purpose of aiding his son, who is now about 14 years old, to follow and complete the course of training which the late Professor had planned for him. It is suggested that if each of his students would subscribe even a small sum sufficient funds would be available to carry out the scheme. Donations should be addressed to Mr. E. F. Armstrong, 98, London Road, Reading, if possible before the end of February, so that immediate action may be taken.

THE FORMATION OF DEPOSIT BY TRANSFORMER OILS.

BY P. N. HOOPER.

Mr. Symons's interesting contribution on the above subject* must be welcomed and treated with the consideration it deserves, because so little has been done, and so much remains to be done, before any final decision can be arrived at as to the actual composition of this deposit, and the change which takes place in the oil during its formation.

Mr. Symons attributes the work that has been done on this subject to the fact that Mr. Peck called attention to it in the discussion on Messrs. Digby & Mellis's paper on the "Physical Properties of Switch and Transformer Oils," which was read before the Institution of Electrical Engineers at Manchester on March 22nd, 1910. I feel, however, that credit should be given to the staff of the Newcastle Electric Supply Co., who early in 1908 called the attention of the firm, Messrs. Alexander Duckham & Co., Ltd., to its presence, and asked them whether they could offer any explanation; since that date both these firms have been continuously carrying out research work in connection with it. I could wish that our Mr. A. Duckham could offer his views as a chemist on a subject in which he has been so keenly interested, and on which so much work has been done in his private laboratory, apart from the investigations carried out by my firm; but, unfortunately, his absence on a tour of inspection of oil fields will keep him abroad for some months, and therefore I am venturing, as far as may lie in my power, to put before your readers what I know of some of the results that he had obtained.

It was in December, 1908, that we informed the Newcastle Co. that the deposit was certainly not due to a deposition of wax, as had been suggested by them, for as a matter of fact, there was absolutely no trace of wax to be found, as would have been predicted by a chemist cognisant of the conditions, especially those of temperature, but we were able to say definitely that the deposit contained, as its most striking constituent, saponifiable matter, which was apparently combined to some extent with lead and manganese. At the same time, we were dissatisfied with the results of our tests, because there was no doubt that the compounds containing oxygen were far in excess of those which, according to the state of our knowledge, could be expected to be combined with the metals in question, if the compounds were to be regarded as the ordinary salts or soaps of fatty acids. The results were sent on to the Newcastle Co., and were submitted by them to the Wallsend Laboratories, who, at the end of 1909, reported that their investigations confirmed the results which we had set forth. However, before those results had been confirmed in this way, we had definitely discovered the source of the lead and manganese as coming from the compound mica sheet which had been used in the construction of the transformers, and, further, we had also had samples of transformer deposits which were practically free from lead and manganese, and consisted almost entirely of a hydrocarbon body combined with oxygen; in our opinion, it is that last-mentioned compound which is the essential constituent of all transformer deposits. Not only do we find it in transformers, but we have come across it as a deposit in lubricating systems, for instance, on turbines where the oil has been pumped round and round over a considerable period of time, at a warm temperature. Again, we have found it in Cutting oils where the oil has been circulated over long periods, and in the course of its use comes into intimate contact with the air.

Going to an entirely different sphere, for a last instance, I would refer to a totally different source in which this compound can be found, and that is bitumen or asphalt, which has been formed in nature by a process of evaporation and oxidation of mineral oils; in such bitumen compounds of this type exist.

Although for some considerable time we have been carefully considering and working on the exact constitution of this compound, in the hope of even giving it a definite

* ELECTRICAL REVIEW, December 22nd and 29th, 1911.

chemical formula, we have so far made no perceptible progress, and as any chemist knows, research work of that kind may last a lifetime without being rewarded by achievement of the end in view.

With diffidence I venture to comment on some of the results which Mr. Symons has published, in the hope that my remarks may be of interest to your readers, and, perhaps, even of some use to those who, like ourselves, are investigating the subject.

The standards which he adopts for heating are of interest, and it is a pity that those users of transformer oils who issue specifications cannot agree to adopt some definite standard. As an instance of the variance in the specifications which come before us, I would mention that in one case we have to undertake a continuous heating test for 700 hours at a temperature of 110° C., whilst at the other extreme we are requested to make our test at a temperature of 200° C. for the short period of eight hours. Then, in some instances, the oils are heated exposed to air, whilst in others it is specified that oxygen shall be bubbled through the oil. At first sight it would seem desirable to use the most rapid means—*i.e.*, to bubble oxygen through the oil at as high a temperature as might be safe, and for the shortest period of time that would give comparable results; for, like all oxidising actions, this formation proceeds more rapidly with the increase of temperature, and with the state of concentration of the reagents which enter into the combination. But there is quite a sound argument which has been put forward against such a drastic test—and that is, does such a rapid test truly represent what is going on in the transformer, and therefore is it not better to use a slower method, and more moderate treatment?

Personally, we are against such slow treatment, as we believe that all the information which is required can be obtained by the more rapid means; indeed, to satisfy ourselves as to the quality of the oil under consideration, we employ ozone as being the more active form of oxygen, and we keep our temperature as high as we dare, having in mind the danger of actual combustion.

Mr. Symons says that the discoloration of the oil can, to some extent, be taken to indicate the liability of oil to form deposit. Although this is to some extent true, when the oils to be compared are of the same chemical constitution, for example, if they come from the same type of crude, yet when one is comparing an oil which is chemically inclined to the aromatic series with one which is rather of the aliphatic series, colour cannot be taken as an indication, and as at the present moment transformer oils of these two divergent types of chemical composition are in common use, it would be quite unsafe for the user to rely on the discoloration test as an indication of the value of two such oils.

Mr. Duckham is absolutely at variance with Mr. Symons when the latter gentleman says that this chemical action is due to heat, and not essentially the result of oxidation, for I remember well that Mr. Duckham conducted experiments in which the same oil was placed in two different flasks, maintained at a high temperature. Through one of them he bubbled air, and through the other nitrogen, or rather air from which all the oxygen had been removed, and whereas the oil in contact with air (*i.e.*, oxygen) in due course gave a heavy deposit, there was not the least sign of any deposit forming in the vessel which was treated with nitrogen. Of course, in such a test as this, the oil through which the nitrogen bubbled became darker because evaporation and a certain amount of decomposition occurred, but, nevertheless, the darkening in colour was negligible, as compared with the deep black shade to which the original pale yellow oil was converted in the oxygen-treated flask. Another of his experiments shows, however, that the heat alone, at any rate at temperatures up to 150° C., has little or no effect on the colour, for he heated tubes of the same oil in contact with air and various gases at this temperature, whilst from one tube the atmosphere was exhausted, and it was then sealed, and in that tube in which no distillation or oxidation could occur, the oil was the same colour at the end of the experiment as at the beginning, whilst all the other open tubes had darkened, and formed deposit to varying extents. Of course Mr. Symons is quite right in saying that oxidation produces no appreciable deterioration in any reasonable time if the oil be cold, for all chemical actions are greatly accelerated by heat and retarded by cold. My point is that all the evidence which we have obtained goes to show that heat by itself does not cause this change, and that the oxygen, or a similar reagent, must be present. As an example of what I mean by a similar reagent, I would mention sulphur, which of all chemical elements is the one which in its reactions and combinations most closely resembles oxygen.

Mr. Duckham carried out preliminary tests with sulphur, and those tests showed that with sulphur, oxygen being entirely excluded, a similar action of darkening and of deposit occurred, and he hopes to be able to show before long that these combinations, whether with sulphur or oxygen, are of essentially the same structure.

Although it is, perhaps, rather out of place in these comments of mine to call attention to Mr. Symons's remark, "That the percentage loss in weight on heating will vary with the flash-point of the oil," yet I consider it necessary to do so, because it may be somewhat misleading, in view of the fact that many oil manufacturers do not supply what might be considered a "straight" distillate from the crude, but are in the habit of blending a somewhat heavy and perhaps an extremely light distillate to obtain certain results as to viscosity, &c.; in such a case the flash point could not be taken as a correct indication of the evaporating properties of the compound oil. To make my meaning clear, I would give a somewhat extreme case in which a heavy cylinder oil might be blended with a light boiling spirit in order to reduce its viscosity, and whereas the flash point of the cylinder oil might be some 500° F., yet the presence of 10 per cent. spirit would reduce the flash even below ordinary atmospheric temperatures, *i.e.*, below 60° F., and therefore in our opinion the actual evaporating tests ought to be carried out, or better still, a distillation test, the temperatures being noted at which, say, every 10 per cent. distils over.

It is somewhat difficult to follow what Mr. Symons means when he says that the physical changes are more moderate than the chemical changes when oils are submitted to a heating test (it being understood that oxygen or air has access), for we find that there is always under these circumstances a rapid regular and easily recognised chemical change, and we have found it quite inadvisable to take physical changes as a criterion of the liability of the oil to form deposit. In carrying out the tests, it is certainly, as emphasised by Mr. Symons, most advisable to keep a uniform temperature, but we have found it unreliable to do so by a method of stirring, and we adopt the precaution where possible of making the tests in a carefully jacketed hot-air oven, in which is fixed a cradle or "cruet," in which the samples are placed; this cruet is revolved round a vertical axis by clockwork during the whole of the test, and by adopting this precaution we find that by far the most uniform results have been obtained.

As to the formation of acids in the oil, Mr. Symons says that the most marked change is the increased acidity. We must say that we do not consider this to be so marked as the chemical change which takes place in the formation of the deposit, and, moreover, we have not so far felt confident in saying that the oxide which is formed is an acid in the true acceptance of that word, notwithstanding the fact that it certainly combines or reacts with alkalis; but the point which I specially wish to emphasise in connection with Mr. Symons's statement as to increased acidity, is that by this opinion he indirectly admits that oxygen is, after all, the most necessary agent in this reaction, for without oxygen he certainly could not generate an acid.

As to the colour of the deposits, we have obtained them of such pale colour, that when in suspension in the oil they appear to be absolutely white; but after filtration they have been found to be of a very pale lemon colour, and it has been our experience that the variation in colour of these deposits cannot be considered as being affected by the colour of the oil at the completion of the heating test. Mr. Symons appears to think that he has reached finality in the formation of deposit from a given volume of oil by continued heating, but with us, even with our 700 hours' test, we have never reached that point; yet there is no doubt that if an oil be submitted to a heating test, and then carefully filtered, on further heating the formation of more deposit is

less rapid. Our theory in connection with this matter is that oxygen combines with the unsaturated hydro-carbon molecules, and leaves practically unaffected those molecules which are fully saturated, and therefore better able to resist the action.

A point that we have noticed in the formation of these deposits is that some oils give well defined granular solid matter which rapidly sinks to the bottom, whereas oils of somewhat different chemical composition, under the same test, will form a quite impalpable flocculent body which will remain suspended for a long time in the oil, and if a mixture of such different oils be submitted to the test, you distinctly obtain both types of deposit, the granular form sinking at once to the bottom, and the flocculent, and paler formation, remaining in suspension.

In order to expedite the settling of the flocculent formation, it may interest some of your readers to know that we find that these deposits are insoluble in petroleum ether, and on the addition of a certain amount of that liquid to an oil after its heating test, the settlement is far more rapid. Indeed, an oil which has been heated for only a short time, and is quite bright, may begin to form a deposit as soon as petroleum ether is added. This insolubility in petroleum ether is a most valuable help in separating deposits for examination. Again, there are certain solvents in which these deposits are soluble, and from which they can be recovered on evaporation, which characteristic is again, of course, of the greatest use.

Another experience we have had with a heated oil is that after a certain amount of deposit is formed, and the oil allowed to become cold, if it be then filtered so that it is perfectly bright, on further standing it becomes gradually misty, and a further amount of deposit can be extracted. This characteristic we have not endeavoured to explain.

As Mr. Symons has stated, one would expect to find the so-called saponification value to be higher in the deposit than in the oil, because, after all, the deposit consists almost entirely of the oxide mixed with a little oil, whereas in the oil the proportions are reversed, as there will only be a very small proportion of the oxide in solution.

We cannot agree that "only a pure oil which will completely evaporate at a high temperature, leaving no residue," will give immunity from deposit, at least if air has access to the oil during the process of evaporation. To put my meaning more clearly, we have found that an oil which on distillation out of contact with the air, gives little or no solid residue in the flask, is quite as liable to form this special type of deposit as an oil which under the same circumstances leaves a heavy pitch-like residue, and in our opinion the actions cannot be considered in any way as related to one another, because, after all, the evaporation or distillation test, and the subsequent formation of pitch-like deposit, is simply a question of decomposition out of contact with oxygen, whereas the formation of transformer deposit is to be considered entirely one of oxidation without the question of decomposition coming into the action in any way, and the two solid bodies obtained from the different methods do not resemble each other physically or chemically.

The Newcastle Co. called our attention to a very important phenomenon which they had observed, viz., that in the presence of copper the formation of deposit was far more rapid; to check their statement we heated for 300 hours at 240° F. two samples of the same oil exposed to the air. They were in closed vessels, and in one of them copper foil was placed, so that 20 sq. in. of it were immersed in the oil. It was at once visibly evident that the sample containing the copper had deposited a greater amount than the other. The whole of the deposit of each sample was carefully extracted, washed, dried and weighed, and the copper heated sample gave ·750 per cent., as against 0·059 per cent. in the other sample. On this it at once occurred to us that perhaps the copper had combined with certain oxides, or perhaps even in the suggested capacity of acids, to form a copper salt, but on testing the deposit it was found that the copper existing in it was only a very slight trace, and certainly not in a large enough proportion to satisfy our copper salt theory. And, indeed, this almost looks as though the action would have to be classified as catalytic, which expression after all is not really understood by anybody, but forms a convenient word to hide our ignorance of the reaction and simply serves to convey the information that the copper is necessary to the reaction, but that its exact function is not understood. We are now making experiments with other metals in the hope that we may obtain interesting results.

Some of the German firms make another interesting test, which consists of heating the oil in which is immersed cotton tape; at the end of the experiment they test the tensile strength of the cotton and also what they term the acidity of the oil.

In concluding these remarks, I would say that, although we personally have not heard anything as to whether the Germans have been doing research work on this deposit question, we cannot help feeling from some of the results which they have obtained in practice, and from the type of oil which they recommend for transformer work, that they must have had for some time past a considerable knowledge of what are the desirable chemical qualities in the oil, even if they have not been aware of the actual *raison d'être*.

TRADE STATISTICS OF CANADA.

THE following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1911, are taken from the recently issued trade statistics. Figures for the year 1909-10 are given for purposes of comparison and notes of any increases or decreases have been added :—

	1909-10. Dollars.	1910-11. Dollars.	Increase or decrease. Dollars.
Brass wire, plain.—			
From Great Britain ...	6,000	5,000	— 1,000
„ United States ...	36,000	37,000	+ 1,000
Total ...	42,000	42,000	—
Railway passenger cars.—			
From United States ...	121,000	57,000	— 64,000
Tram or horse cars.—			
From United States ...	22,000	5,000	— 17,000
Celluloid manufactures.—			
From Great Britain ...	12,000	9,000	— 3,000
„ Germany	5,000	2,000	— 3,000
„ United States ...	73,000	42,000	— 31,000
„ Other countries ...	10,000	6,000	— 4,000
Total ...	100,000	59,000	— 41,000
Coal, bituminous.—			
From Great Britain ...	91,000	20,000	— 71,000
„ United States ...	12,979,000	14,576,000	+1,597,000
Total ...	13,070,000	14,596,000	+1,526,000
Copper wire, plain, tinned or plated.—			
From Great Britain ...	24,000	1,000	— 23,000
„ United States ...	61,000	64,000	+ 3,000
Total ...	85,000	65,000	— 20,000
Electric light carbons and carbon points.—			
From Great Britain ...	1,000	8,000	+ 7,000
„ Germany	14,000	14,000	—
„ United States ...	28,000	37,000	+ 9,000
„ Other countries ...	2,000	2,000	—
Total ...	45,000	61,000	+ 16,000
Electric apparatus not mentioned—insulators, electric and galvanic batteries, telegraph and telephone instruments.—			
From Great Britain ...	398,000	360,000	— 38,000
„ Austria	5,000	5,000	—
„ France	3,000	7,000	+ 4,000
„ Germany	5,000	45,000	+ 40,000
„ Sweden	17,000	26,000	+ 9,000
„ United States ...	2,487,000	3,751,000	+1,264,000
„ Switzerland ...	—	22,000	+ 22,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	2,916,000	4,218,000	+1,302,000

	1909-10. Dollars.	1910-11. Dollars.	Increase or decrease. Dollars.
Incandescent lamp bulbs, &c.—			
From Austria	19,000	15,000	— 4,000
„ United States ...	53,000	75,000	+ 22,000
„ Other countries ...	1,000	5,000	+ 4,000
Total ...	73,000	95,000	+ 22,000
Electric motors, generators, dynamos and sockets.—			
From Great Britain ...	35,000	24,000	— 11,000
„ France	2,000	2,000	—
„ Sweden	28,000	13,000	— 15,000
„ United States ...	428,000	518,000	+ 90,000
„ Other countries ...	—	1,000	+ 1,000
Total ...	493,000	558,000	+ 65,000
Lamp chimneys, glass shades and globes.—			
From Great Britain ...	7,000	3,000	— 4,000
„ Austria	14,000	13,000	— 1,000
„ Germany	13,000	19,000	+ 6,000
„ United States ...	161,000	245,000	+ 84,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	196,000	282,000	+ 86,000
Rubber belting.—			
From Great Britain ...	13,000	29,000	+ 16,000
„ United States ...	51,000	34,000	— 17,000
Total ...	64,000	63,000	— 1,000
Manufactures of india-rubber and gutta-percha, except clothing and similar goods.—			
From Great Britain ...	112,000	143,000	+ 31,000
„ Austria	6,000	3,000	— 3,000
„ France	3,000	5,000	+ 2,000
„ Germany	39,000	44,000	+ 5,000
„ United States ...	479,000	568,000	+ 89,000
„ Other countries ...	2,000	4,000	+ 2,000
Total ...	641,000	767,000	+ 126,000
Locomotives for railways.—			
From Great Britain ...	33,000	2,000	— 31,000
„ United States ...	314,000	295,000	— 19,000
Total ...	347,000	297,000	— 50,000
Gasoline engines.—			
From Great Britain ...	35,000	126,000	+ 91,000
„ United States ...	955,000	1,322,000	+ 367,000
„ Other countries ...	10,000	17,000	+ 7,000
Total ...	1,000,000	1,465,000	+ 465,000
Steam engines.—			
From Great Britain ...	30,000	43,000	+ 13,000
„ United States ...	217,000	202,000	— 15,000
„ Other countries ...	6,000	—	— 6,000
Total ...	253,000	245,000	— 8,000
Boilers.—			
From Great Britain ...	116,000	52,000	— 64,000
„ United States ...	124,000	128,000	+ 4,000
„ Other countries ...	3,000	1,000	— 2,000
Total ...	243,000	181,000	— 62,000
All machinery not mentioned, except sewing machines, textile machinery, printing machinery, &c.—			
From Great Britain ...	592,000	1,241,000	+ 649,000
„ France	13,000	27,000	+ 14,000
„ Germany	56,000	220,000	+ 164,000
„ United States ...	6,446,000	10,976,000	+ 4,530,000
„ Other countries ...	30,000	93,000	+ 63,000
Total ...	7,137,000	12,557,000	+ 5,420,000
Iron and steel wire, single or several, covered with cotton, linen, silk, rubber or other material, including cable so covered.—			
rom Great Britain ...	161,000	201,000	+ 40,000
United States ...	159,000	286,000	+ 127,000
Other countries ...	9,000	9,000	—
Total ...	329,000	496,000	+ 167,000
Iron and steel wire not mentioned (except fencing wire).—			
From Great Britain ...	46,000	52,000	+ 6,000
„ Germany	23,000	18,000	— 5,000
„ United States ...	141,000	197,000	+ 56,000
Other countries ...	1,000	4,000	+ 3,000
Total ...	211,000	271,000	+ 60,000

	1909-10. Dollars.	1910-11. Dollars.	Increase or decrease. Dollars.
Belting, leather.—			
From Great Britain ...	166,000	185,000	+ 19,000
„ United States ...	7,000	16,000	+ 9,000
Total ...	173,000	201,000	+ 28,000
Lighting fixtures of metal, including electric light fixtures of metal.—			
From Great Britain ...	19,000	24,000	+ 5,000
„ Austria	2,000	2,000	—
„ United States ...	354,000	470,000	+ 116,000
„ Other countries ...	10,000	11,000	+ 1,000
Total ...	385,000	507,000	+ 122,000
Asbestos manufactures.—			
From Great Britain ...	19,000	33,000	+ 14,000
„ United States ...	174,000	212,000	+ 38,000
„ Other countries ...	6,000	9,000	+ 3,000
Total ...	199,000	254,000	+ 55,000
Plumbago, ground and manufactured.—			
From Great Britain ...	4,000	4,000	—
„ United States ...	36,000	39,000	+ 3,000
Total ...	40,000	43,000	+ 3,000
Mica.—	Exports.		
To Great Britain... ...	11,000	61,000	+ 50,000
„ United States... ...	287,000	247,000	— 40,000
„ Other countries ...	1,000	2,000	+ 1,000
Total ...	299,000	310,000	+ 11,000
Electrical apparatus.—			
To Great Britain... ...	2,000	9,000	+ 7,000
„ Newfoundland ...	3,000	3,000	—
„ United States... ...	21,000	110,000	+ 89,000
„ Other countries ...	2,000	10,000	+ 8,000
Total ...	28,000	132,000	+ 104,000
India-rubber manufactures.—			
To Great Britain... ...	9,000	31,000	+ 22,000
„ Newfoundland ...	3,000	5,000	+ 2,000
„ New Zealand	8,000	4,000	— 4,000
„ United States... ...	34,000	50,000	+ 16,000
„ Japan	2,000	—	— 2,000
„ Other countries ...	—	3,000	+ 3,000
Total ...	56,000	93,000	+ 37,000
Machinery.—			
To Great Britain... ...	30,000	78,000	+ 48,000
„ Newfoundland ...	22,000	19,000	— 3,000
„ New Zealand	10,000	3,000	— 7,000
„ Argentina	8,000	8,000	—
„ France...	43,000	4,000	— 39,000
„ United States... ...	238,000	570,000	+ 332,000
„ Other countries ...	90,000	65,000	— 25,000
Total ...	441,000	747,000	+ 306,000

Electric Cabs in Hamburg.—An article dealing with the working expenses of electric motor vehicles, particularly in the cab department, was published in the *Technische Rundschau*, of January 31st, the author being Herr Wendt, of Stettin. It is stated that the working results of the Hamburg Electric Cab Co. show that it is possible largely to reduce the reserve of cabs and the costs per cab-mile with electrical vehicles, as compared with the reserve and costs incidental to petrol cabs. The company possesses a fleet of 88 battery cabs having an average daily performance of 88·66 miles. On the average only four cabs are withdrawn from service for repairs and maintenance, and notwithstanding the long daily service the reserve only amounts to 5 per cent. The average life of the positive plates of the batteries is 10,230 miles, and that of the negatives 20,460 miles, whilst that of the pneumatic tires is 6,820 miles. The total costs are returned at 6¼d. per cab-mile. This figure includes cost of energy at 1½d. per KW.-hour, maintenance of batteries, material and repairs, drivers' wages, general expenses of management, insurance, &c., 4 per cent. interest on capital and depreciation of cabs. The working receipts range from 7·68d. to 9·6d. per cab-mile, according to the extent to which the number of cabs is accommodated to the demand, and to the lesser or greater length of idle journeys without passengers. It is considered desirable that cabs of the same uniform type should be employed if the best results are to be obtained in order to restrict the cost of materials and replacements to a minimum, and to be able to teach the workmen how to undertake the repairs. As petrol cabs are not allowed in Hamburg for hygienic reasons and for increasing the safety of traffic, a direct comparison with such cabs in that city is out of the question. The author, however, does not state the definite financial results of the electric cab company, despite the four years of working.

PROCEEDINGS OF INSTITUTIONS.

The Evolution and Present Development of the Turbine Pump.

By Dr. Edward Hopkinson and Mr. Alan E. L. Chorlton.

(*Abstract of paper read before the* Institution of Mechanical Engineers, *January 19th*, 1912.)

In no domain, perhaps, has the turbine rotary principle achieved greater success in the last few years than that of high-lift pumping, though the realisation of its possibilities of such duties, by some, is perhaps as old as, or older than, the steam turbine itself.

In the year 1875 Prof. Osborne Reynolds invented a turbine pump of the series type, fitted with guide vanes, and essential features of his original proposition have been adopted in subsequent practice

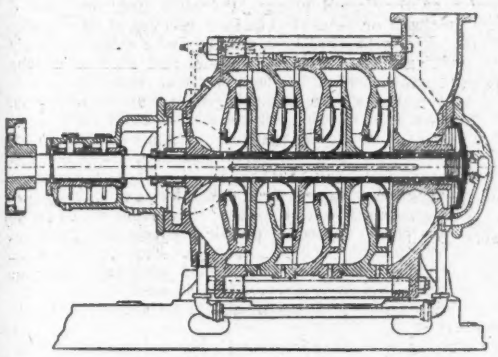


Fig. 1.—Modern Four-Chamber Pump. Section.

The first pump of which records and tests are available was constructed in the year 1887 by the firm of Mather & Platt for the Engineering Laboratory of the Owens College, Manchester. This pump had four impellers in series, and gave at 1,500 r.p.m. a total head of 148 ft., or 37 ft. per chamber. The average efficiency recorded in the tests made by Prof. Reynolds was 58·5 per cent.

The tests of Prof. Reynolds proved the capability of the pump to perform many duties, previously thought impossible by centrifugal pumps, and in 1893 the firm of Mather & Platt took up its commercial manufacture.

A modern four-chamber pump is shown in longitudinal section in fig. 1; its guide vanes and its impeller in fig. 2. Constructionally this pump differs principally from the earlier designs, in that the extended suction end is shortened, and is similar to the delivery end. This enables various classes of drives, motor, belt or steam turbines, to be better negotiated with a standard pattern. Successive chambers, instead of being secured to their neighbours by bolts and flanges, are held together by long bolts extending the entire length of the pump body and held only at the two ends (suction and delivery).

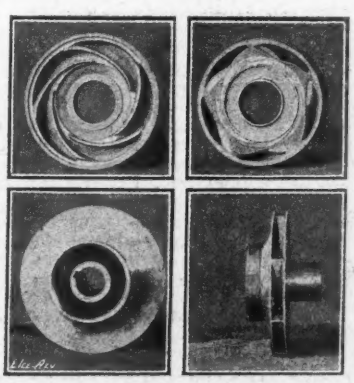


Fig. 2.—Guide Vanes and Impeller of Pump.

The impeller is of the shrouded type, having vanes bent well backwards, and the guide passages are longer and more correctly divergent, whilst the return way to the eye of the next impeller is of a curved form and more in line and continuous with the receptive ports, thus preventing the abrupt right angle turn through the casing obtaining in the Reynolds pump. The losses in the Reynolds impeller through side friction in its casing are obviated, and any leakage from the periphery back to the suction is prevented or greatly minimised by the outer circumference of the impeller eye running in neck bushes with a very small radial clearance, amounting to less than 0·005 in. The importance of preventing

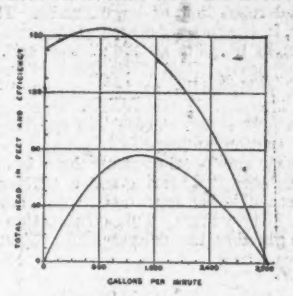


Fig. 3.—Head and Efficiency Curves at 600 r.p.m.

this leakage is very great if high efficiency is to be secured. The impeller is turned all over outside to reduce loss by skin friction,

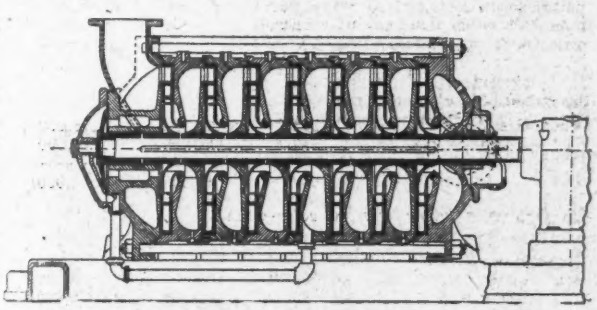


Fig. 4.—Mather & Platt Mine Drainage Pump, 1911. Section.

and with the same object it is usual to use as many wheels as the circumstances will otherwise allow of.

The end or axial balance of the impellers is obtained by the automatic device shown, which acts well in practice, and compensates for wear and variable leakage taking place in the pump. In other respects the arrangement, direction of flow of water, and assemblage of the pump are the same as in the original Mather-Reynolds pump. Representative curves of head and efficiency of such a pump are shown in fig. 3.

A set constructed for the engineering laboratory of the University of Cambridge, in 1900, consisted of a pump at one end, a turbine at the other end, and an electric motor between them.

A similar combination was made use of later for actual installations, amongst others at the Newcastle electric power station, for circulating the condensing water. The pump raised and forced water from the river to the condenser in the electric generating station in the town, the return flow to the river passing through and driving the turbine, and the loss being made up by the electric motor in between.

Figs. 4 and 5 shows a series turbine pump lately constructed for mine drainage. It is probably the mine pump with the largest capacity yet constructed. This pump is capable of delivering 2,500 gallons per minute to a height of 2,000 ft. when running at a speed of 1,450 r.p.m., and absorbs over 1,900 h.p. at the spindle.

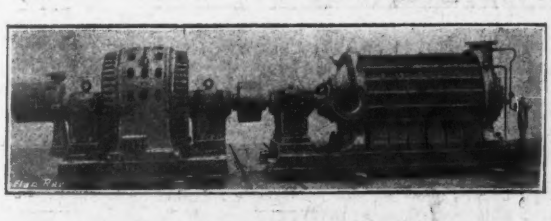


Fig. 5.—Mine-Drainage Pump, 1911.

It is operated by a three-phase motor at 2,500 volts, direct coupled through a flexible coupling of the pin and rubber-bush type.

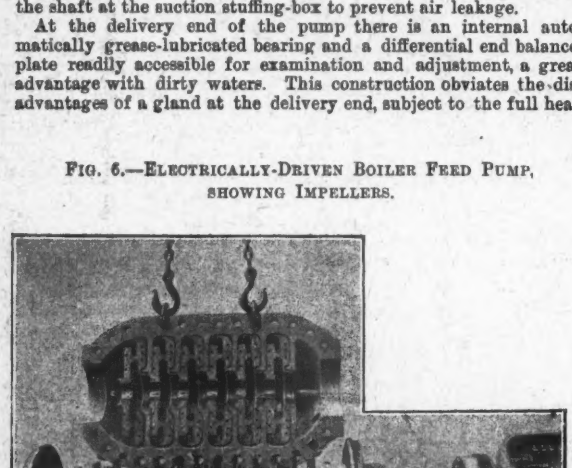
The pump has seven impellers arranged in series, working in chambers, following each other, and not as is sometimes done for such high heads by arranging the impellers back to back, with the intention thus to balance the end-pressure. The series impellers are constructed of phosphor-bronze, and are mounted on a shaft of extra large diameter, to prevent sag in the middle and allow of fine clearance in the neck rings at the eyes of the impellers, thus reducing leakage. The guide-vanes into which the impellers discharge are large castings of special bronze, double-sided and cast in one piece, thus securing increased rigidity.

The intermediate chambers have the return passages from the periphery to the suction of the next impeller cast in. They are of cast-iron, and have feet cast on, which, resting on the planed

surface of the bedplate, support and keep the whole pump in true alignment, a precaution more necessary when the length of the pump is as great as in this case. The construction also facilitates the stripping and rebuilding of large pumps. There is only one exterior bearing, in the form of a separate pedestal standing on and bolted to the main bedplate at the suction end. The reason for this bearing being separate and of such a solid form and not overhung from the pump-casing, as in the more standard form of smaller pumps, is due to the large power transmitted through the pump shaft at a high speed. There is a water-logging passage to the shaft at the suction stuffing-box to prevent air leakage.

At the delivery end of the pump there is an internal automatically grease-lubricated bearing and a differential end balance-plate readily accessible for examination and adjustment, a great advantage with dirty waters. This construction obviates the disadvantages of a gland at the delivery end, subject to the full head

Fig. 6.—Electrically-Driven Boiler Feed Pump, showing Impellers.



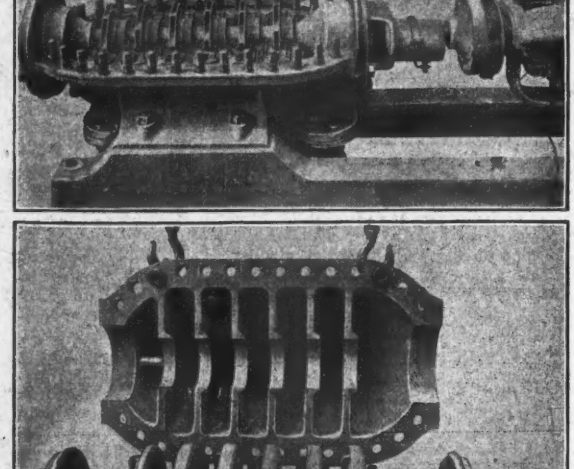


Fig. 7.—Boiler Feed Pump, with Guide-plates in Position.

pressure, with its attendant leakage and cutting of shaft. The lubrication of the internal bearings is effected by a piston worked by the head pressure pumped against.

Figs. 6 and 7 show an electrically-driven boiler feed-pump, consisting of two six-chamber pumps in series, of the split-body type, allowing of the whole of the inside impellers, shaft and guides being taken out together when the top half-cover is removed. This is a much simpler and quicker operation than taking adrift a standard type, but it is a more expensive form of construction.

The difficulty in such a design is to deal with the 260 lb. per sq. in. internal water pressure on the split joint. Reference to the illustration will show how this is accomplished. It will be seen that the impellers are surrounded by guide plates, put on in halves and bolted together, and the whole is then placed in a casing divided in the middle horizontal plane. The casing is provided with as many dividing ribs as there are impellers. Turned bosses on the guide disks rest in suitably machined seats in the dividing ribs. The top cover is bolted on to secure them in their places, and they are prevented from rotating by pins. The main joint against heavy pressures is thus a plain one and of great rigidity, and can easily be maintained tight. The capacity of the pumps shown is 140 gallons per minute, 260 lb. per sq. in. delivery pressure at 1,270 R.P.M.

The Institute of Metals.

At the annual meeting of the Institute of Metals held recently in London the question of the utility of the Institute to practical men was again raised. Sir Gerard Muntz, in acknowledging a vote of thanks accorded to him on vacating the office of President after serving in it with distinction for two years, referred to criticism in the Press and elsewhere as to the utility of the Institute, and to the suggestion that it had drifted too much on the scientific side. Now that he was no longer President he could say, speaking as a manufacturer with many years' experience behind him, that far from being too scientific, the Institute had yet a long way to go in the scientific direction. The manufacturer would be the first to criticise such a tendency, and in his turn would give a practical answer to the papers of the scientist. His opinion was that the Institute had done an enormous amount of useful work for the practical man, and that it would become more and more valuable to the scientific and the practical men, who by working together could be of great mutual assistance to each other.

That may be regarded as Sir Gerard's *apologia*, and it is no easy matter to find fault with the manufacturers' or users' point of view upon such a matter when expressed by so distinguished a representative as Sir Gerard Muntz. Criticism has been directed against the Institute on several occasions because of the undue proportion of what, without offence, may fairly be called academic papers, but judging from the list of papers and authors at the London meeting this criticism has been without beneficial effect. Practically all the papers were academic rather than works papers. It is true that, more than in the past, science must come to the aid of industry, but it is also equally true that a study of the results obtained in practice is of as great importance as a theoretical discussion before practical trial. If the Institute continues to be mainly the mouthpiece of the research laboratories of our colleges it is doomed to comparative failure, and the Council will be well advised to make efforts to secure practical papers and practical discussions to supplement their present type. Further, it is to be hoped that the practical members will not hesitate to ask the readers of academic papers to state clearly in what direction the scientific principles and data described can be applied to works practice.

To the unusually interesting inaugural address prepared by Prof. William Gowland, the new President, with whom genuine sympathy was felt in his enforced absence from the meeting through illness, only a passing reference need be made here. Prof. Gowland maintained that till the rise of Greek and Roman civilisation, but little use was made of metals which must have been first known to the men inhabiting the localities in which they occurred. His main thesis, however, was to emphasise the idea that "the influence of copper, and particularly of bronze, is an element which has played a greater part in the civilisation of Europe than that of any other metal," and in the development of this he gave a mass of valuable information about the discovery, working and use of alloys.

The first paper taken was by Mr. Arnold Philip, the Admiralty chemist, and dealt with the corrosion of condenser tubes by contact with electro-negative substances, this constituting the first part of a series of contributions to the history of corrosion that the author has promised to present to the Institute of Metals. Mr. Philip's paper revealed a very satisfactory condition of affairs concerning the millions of tubes in use in the Royal Navy, which have been systematically preserved by the presence of electro-positive metals placed near and in metallic connection with them. Mr. Philip said that, though 10 per cent. of the failures referred to by him appeared mysterious, it was quite possible that the lack of any ostensible cause for the corrosion in these instances was due to the absence of fuller detail as to whether the tubes had been exposed to contact with electro-negative materials, such as coal, iron and the like. In the second place, when condensers were not in use, it was only sometimes that they were dried out by steam, whilst in others the water was merely drained off. He believed both causes had much to do with failures, but that the electrolytic action of particles resting in the tubes was more important in producing corrosion than the layer of salt water left on "draining off" the condenser. In his own experience, 90 per cent. of the tubes gave out along the bottom, but this experience was based solely on bad cases of corrosion, as minor ones were not referred to him, so that it was quite possible that the experience of others on this matter might be different.

Mr. G. D. Bengough, who opened the discussion, said that in his opinion the electrolytic theory of corrosion was sufficient to account for all the cases of corrosion within his experience. That is a very important point, because in certain quarters that theory has not received approval. Mr. Bengough pointed out that as far as Admiralty brass (copper 70 parts, tin 1 part and zinc 29 parts) was concerned there were very few cases of corrosion. All that seemed to be necessary was that they should evolve some sort of cheaper metal which would resist corrosion as well as Admiralty brass.

Mr. A. E. Seaton called attention to the fact that there were no complaints of defective tubes in the Navy. The investigations which had taken place would help the work of the Corrosion Committee, and he had great hopes from the work which was now to be put in hand.

Mr. Anderson said there was reason to believe that the means of preventing corrosion would be found in an electrical method. He was astonished that corrosion troubles were so rare in Admiralty practice, as in the last three months he had become acquainted with 60 to 70 cases, in many of which protective devices as mentioned by the author were in use. A great many of these had been in power stations and in the mercantile marine, but an appreciable proportion of the tubes had been of Admiralty mixture.

It might be taken from the information given that, although such cases were rare, the Admiralty mixture tubes were still liable to corrosion and pitting in the absence of an electro-positive mass. He agreed with the author's view that no matter how efficient the protective mass might be, its effect could not be attained unless good metallic contact existed between the tube to be protected, and the protective mass. He would like to know what means, if any, were used to ensure such contact. In his (the speaker's) system the plan adopted was to provide each tube with a soft metal washer placed in the stuffing-box on the top of the ordinary packing, which when screwed up afforded ample contact between each separate tube and the tube-plate. It would also be of interest if the author could give any particulars of the current conveyed to the tubes by the protective blocks employed. He had recently been watching the behaviour of blocks fitted to a condenser in such a way that the electric current generated could be measured. The results showed that the current generated per block ranged from ½ to 1½ amperes, and that the average current in the condenser was about at the rate of 1 ampere per 1,000 sq. ft. of surface. Pits might occur in any position, and in his experience it was rather the exception to find them confined to any one latitude. This did not preclude the idea that even in other positions than the bottom, electro-negative particles might have attached themselves to the inside. It was found, however, that in many cases attacked tubes were completely and evenly lined with ferric oxide all over, with local perforations. His own view was that stray currents had a great influence on the corrosion of condenser-tubes, and might safely be assumed to account for a larger proportion of the mysterious cases. Generally, however, sea-going engineers were not provided with instruments which would detect them.

MR. E. L. RHEAD said that the possibility of electrolytic disturbances arising from the gases liberated from the water was as great as it was in the case of solid bodies. Solids deposited in a tube were centres from which gases were liberated. The question was not one concerning any gas in particular, but all gases liberated in contact with the tube would promote corrosion. In boiler practice, for instance, it was found that corrosion was especially prevalent when the feed was drawn from water contaminated by sewage. Corrosion did not usually extend to all parts of a tube, but was most prevalent where the water entered, which was just what would be expected if gases were liberated, and acted as the effective cause. In the case of corrosion of turbine-driven propellers, it had been found that this was specially prevalent in areas of reduced pressure. It was here that gases would be liberated, and he believed that the erosion was due to this, and not to the velocity or pressure of the water.

MR. PHILIP, in reply, expressed his agreement with the view that stray currents might be an effective cause of the damage in some cases of corrosion; but he did not think it was so frequently responsible, as was the contact of electro-negative substances with the tube. He had called attention in his paper to the ill effects attending the practice of merely draining off condensers when putting them out of use. The patches of corrosion, when at the bottom of the tubes, were always elongated. In view of the facts brought forward, he had proposed the use of vertical tubes, but the practical necessity of maintaining accessibility made these difficult to adopt at sea.

PROF. TURNER then read his paper on "The Behaviour of Certain Alloys when Heated in Vacuo," in which he showed that by heating brass in vacuo a separation of the zinc and copper could be effected in a very short time. Other alloys were also investigated. As the result of certain experiments, he suggested that the process described by him might prove industrially valuable in refining crude copper.

MR. VAUGHAN HUGHES, who took part in the discussion on the paper, referred to some work of his on incandescent lamps in the early eighties, when he found that in such vacua as were used even platinum would vaporise at comparatively low temperatures. This fact had made it necessary to reduce the area of the platinum exposed. Other metals, such as copper, nickel, and the like, were completely volatilised in the same conditions.

DR. WALTER ROSENHAIN next presented a paper in which he drew attention to the confusion which existed at the present time in the nomenclature of alloys; the name of an alloy, he said, conveyed no indication of the true nature of the material, and was in some cases quite misleading. These remarks did not apply so much to the well-known alloys, such as Muntz metal, naval brass, and similar alloys. When, however, an alloy consisting essentially of copper and zinc, and containing not more than 0·2 per cent. of manganese, was described as "manganese bronze," the need for some reform in the nomenclature became evident. There were also no clear demarcations between such terms as "brass" and "bronze." Much confusion existed as to the group of alloys of copper, zinc and nickel, some of which were known as "German silver." The alloys of aluminium with copper also presented difficulty. The object aimed at, concluded the author, would not be to introduce exact technical names into general commercial use, so much as to provide the engineer, in drawing up his specifications, and the analytical chemist in testing material under these specifications, with a clear set of names by which the general type of alloys could be distinguished.

Another paper to which brief reference should be made is that presented by Mr. R. H. Greaves, who explained the influence of oxygen on copper containing arsenic or antimony. The alloys were prepared synthetically from pure electrolytic copper. Oxygen was introduced as cupric oxide, and arsenic or antimony was added in the form of a rich alloy with copper. It was found that with constant arsenic, addition of oxygen causes no marked difference to the malleability until a certain limit (depending on the arsenic present) is reached; above this point the malleability falls off, and with still more oxygen there is a rapid deterioration of the metal, which becomes cold-short. The addition of arsenic or antimony to pure copper hardens it; the effect of either on copper containing oxygen is first to diminish and then increase its hardness. The addition of oxygen to arsenical copper is without any marked influence on the hardness until it reaches a limit depending on the percentage of arsenic, when the hardness rapidly increases. Thus copper with 0·4 per cent. arsenic and 0·3 per cent. oxygen is quite as soft as, if not a little softer than, a similar metal free from oxygen. The limit of the percentage of oxygen which does not noticeably affect the hardness rises to about 0·35 per cent. as the arsenic increases to 0·5 per cent. Antimony first diminishes and afterwards increases the hardness of copper containing oxygen, while quite a low percentage of oxygen begins to harden copper containing antimony. Sir Gerard Muntz said that he had also called attention to the influence which oxygen had on copper, and Mr. Greaves's results to a large extent confirmed his own.

Dynamos for Motor Road Vehicle Lighting.

By J. D. MORGAN, A.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *at Birmingham, January 10th*, 1912.)

DURING the past few years serious attention has been directed to the development of electric lighting systems for motor road vehicles, as it is widely recognised that something superior to the ordinary methods of oil and acetylene lighting is urgently needed. By common consent, the use of a battery alone for providing current is unsuitable, and a dynamo is essential.

The principal conditions to be complied with are: (*a*) That the dynamo must be capable of maintaining a practically constant voltage over a wide range of speed variation and under different loads; and (*b*) if voltage variations are unavoidable, the amount of variation must not seriously affect the brightness of the lamps. Regarding the first condition, it is usual to arrange for the dynamo to supply current at the normal voltage when the vehicle is moving at the rate of from 10 to 15 miles per hour, and to maintain the voltage constant, or as nearly constant as possible, at all superior speeds, which may reach 50 to 60 miles per hour. When the vehicle is at rest or travelling below 10 miles per hour, the current is supplied entirely or for the greater part by a battery arranged in parallel with the dynamo circuit. Regarding the second condition, it is known that in metal-filament lamps a small increase above the normal voltage is attended by a relatively large increase of brightness. An experiment on a 4-volt lamp showed that an increase of the voltage from 4 to 5 caused the candle-power to increase from 3·6 to 8.

Several attempts have been made to construct machines in which a series compensating winding is used, the idea being to diminish the strength of the field progressively by the current in such winding after the normal voltage has been reached. Obviously a constant voltage cannot be obtained, but what is aimed at is to keep the voltage variation within practical limits over a given range of speed variation. A machine embodying this principle for road vehicle lighting is produced by Messrs. Bleriot, Ltd., and is illustrated diagrammatically in fig. 1. The shunt winding *a* is connected across the external circuit, and the current leaving the armature passes through the series winding *b* before reaching the shunt winding. A centrifugal switch at *c* closes the external circuit when a certain speed is attained. By the Bleriot method a much larger voltage variation can be produced at the brushes than is experienced in the external circuit, and the current through the shunt winding is subject to smaller fluctuations than it would be if connected across the brushes. Consequently a greater compensating effect can be obtained from the series winding than would otherwise be possible. Between the speeds of 1,600 and 4,000 revs. per minute the voltage rose from 10·5 to 13·75, and the current increased from 6 to 18 amperes. Over the same range of speed variation the voltage at the brushes rose from 11·5 to 16·75. The increasing difference between the two voltage curves illustrates clearly the usefulness of the arrangement of the windings in the Bleriot machine for regulation purposes.

As a result of the test it may be urged that the performance of the Bleriot machine was not satisfactory. The regulation of the machine is dependent on the condition of the battery. With the battery run down superior regulation was experienced, but when the battery approached the fully charged condition the voltage in the external circuit increased without increase of speed. The best results as regards steadiness of voltage are obtained when the maximum output does not exceed the consumption by more than about 2 or 3 amperes. With some batteries this figure may be increased, but in all cases a heavy charging current should be avoided.

All machines which are regulated automatically by an increase of current in some part of the system which is in communication with the external circuit appear to be useless without a battery.

An exceedingly good and interesting machine of the interbrush type is that of Messrs. Trier & Martin, which is illustrated diagrammatically in fig. 2. The machine is of two-pole shunt-wound construction, and is provided with a pair of intermediate brushes *a a'* placed midway between the ordinary main brushes *b b'*. The main and interbrushes are connected together through resistances *c*. The arrangement differs from the more familiar Leitner arrangement in that the interbrushes are connected to the main brushes instead of to the field windings. The makers describe the action of the machine in their patent specification as follows:—"As *b* is the negative and *b'* the positive brush, the current in the re-

sistance connecting the main brush b' with the auxiliary brush a' will, when the machine is running on open circuit, flow from b' to a' and, in the resistance connecting the other pair of brushes, will flow from a to b. The effect of these currents, which, of course, also flow in the armature coils between b' and a', and a and b, is to

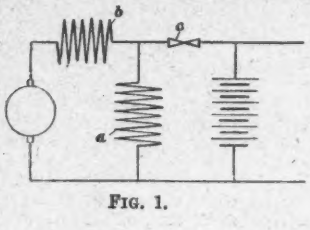


FIG. 1.

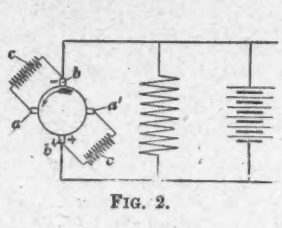


FIG. 2.

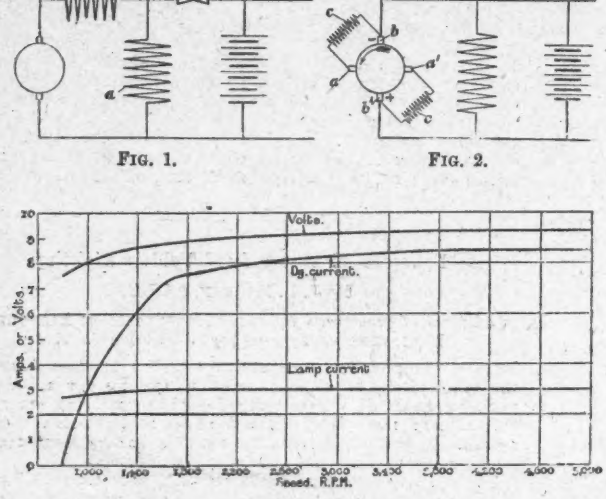


FIG. 3.

strengthen the main field. As the load increases, an armature reaction is set up which displaces the axis of the field forward, and by so doing reduces the current in the resistances c, and, consequently, the magnetic field is also reduced. When the axis of the magnetic field is displaced by 45°, there will be no current at all between the main and auxiliary brushes, as they will then be at equal potentials. A further displacement of the magnetic field due to increasing load and speed will cause a current to flow again between the main and auxiliary brushes, but such current will now be in the reverse direction, and its effect will be to weaken the main field instead of to strengthen it. Thus the output of the dynamo becomes self-regulating."

The performance of the machine is illustrated in fig. 3. In the tests an 8-volt battery was used. The output rapidly rises until a speed of about 1,600 R.P.M. is reached. Above this speed the output rises very slowly and keeps within a practical limit. As with other self-regulating machines, a battery is essential, and the maximum voltage and current obtained depend to some extent on the condition of the battery. The variations with changes in lamp load are insignificant. With lamps consuming 4½ amperes the maximum current given by the machine was 8 amperes.

Another interesting machine is the Midgley-Vandervell, or C.A.V. machine. This is of the type with which electrical engineers have been familiarised by the Rosenberg machine, depending for its self-regulating property upon the short-circuiting of certain armature windings. The principle of the C.A.V. machine is illustrated in fig. 4, where the upper view shows the connections and the lower one the magnetic system alone. Two opposite pairs of poles a and b are united by the body c. The poles a are provided with shunt windings, whilst the poles b are left unwound. Current is supplied to the external circuit by the armature windings under the poles b through brushes d, and the armature is wound in such a manner that the brushes also short-circuit armature coils lying in the neighbourhood of the leaving edges of the poles a. The initial path of the magnetic flux is indicated diagrammatically by the thin dotted lines in the lower figure. When the current in the short-circuited coils reaches a certain value, the magnetism associated with them appears to break down the principal flux at the parts adjacent to those coils, and causes the flux to swing into opposite quadrants as indicated by the thick dotted lines in the figure. At this stage the machine becomes self-regulating, as the cross-magnetisation due to the armature coils under the poles b counteracts the principal flux, and so progressively weakens the field as the speed increases. This action proceeds to a limit beyond which, under a given load, the voltage and current are constant at all speeds.

The above explanation is based upon information contained in the inventors' patent specification, but whilst apparently satisfactory as a general guide to the action of the machine, it does not appear to be complete, for long before a marked change occurs in the disposition of the flux, current is supplied to the external circuit, which suggests that the two dispositions of flux shown in the figure exist concurrently at all speeds.

The behaviour of a machine in practice is shown by the diagram in fig. 5, which is representative of a large number of tests with the machine coupled to a battery and lamps as in service conditions. When the maximum voltage is reached it remains remarkably steady. A drop is shown in current at the higher speeds. This is probably due to defective brush contacts. It will be observed that the maximum current directed into the battery was 1·2 amperes. With such a small charging current a practically uniform condition is maintained in the battery, and the latter is, therefore, not so likely to interfere with the regulation of the machine as when a machine is used the output of which is largely in excess of the demand. Using the head lights only, the maximum volts increased

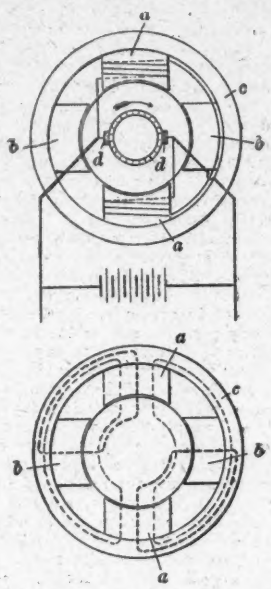


FIG. 4.

from 13 to 13·5, and using the side and tail lights only, the maximum volts rose to 14.

When a battery is used, an increase of voltage is attended by a proportionately larger increase of current passing through and from the machine, and in consequence self-regulation can be obtained. This fact is of great importance, inasmuch as it makes the battery an indispensable part of the equipment.

Another interesting self-regulating system is that of Grob, shown in fig. 6. The machine a is separately excited by a battery b, and the field windings c are connected between the positive poles of the battery and machine respectively. With increase of voltage across the brushes the difference of potential at the ends of the windings diminishes, and in consequence the strength of the field diminishes. This action rapidly proceeds to a limit above which the voltage and output of the machine under a given load remain fairly constant at all speeds. The system appears to be capable of giving good results, but it possesses the serious disadvantage that a battery of twice the normal size must be carried in order that one-half may be charged

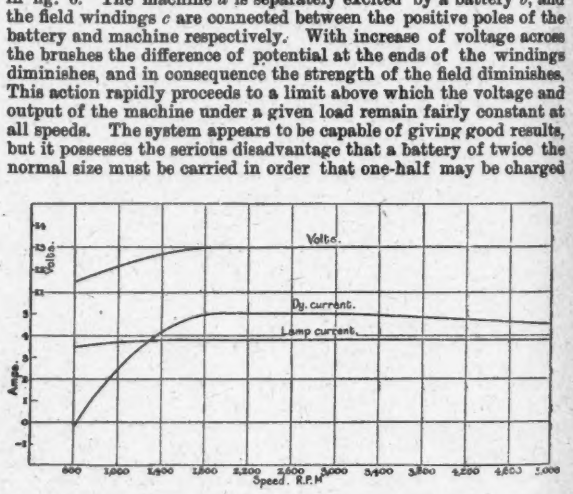


FIG. 5.

whilst the other half is in service. Further, the permanent or residual magnetism of the machine seems to prevent a perfectly steady voltage from being obtained.

Mechanically regulated dynamos depend for their action upon some moving part. In one machine the armature is moved axially by a governor, so that the number of lines cut by the armature winding varies practically inversely as the speed. In another machine the air-gap is widened or contracted, either by the use of

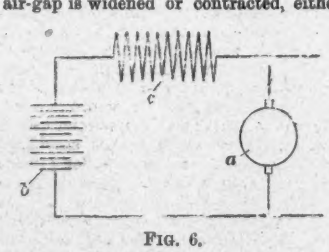


FIG. 6.

governor-controlled hinged pole-pieces, or by a conically-shaped armature which moves axially under the action of a governor between conically-shaped pole-pieces. Sliding masses of iron for varying the flux through the pole-pieces have also been proposed. The idea of shifting the brushes automatically seems to have been

popular with inventors. A very common method of regulation consists in the use of a field regulator actuated by a governor; this is undoubtedly a simple and practical procedure, but the difficulty appears to reside in the production of a sufficiently simple regulator capable of withstanding the conditions experienced on the roads.

The most important of mechanical devices hitherto produced for regulation purposes are those depending upon a slipping drive. These are divisible into two classes, which are characterised respectively by constant torque and constant speed. A constant torque device is wrong in principle for motor-car lighting. In motor-car practice it is common to arrange the side and tail lights in series under the control of one switch, and the head lights (if two are used) in parallel under the control of another switch. To cut out either set of lamps causes a big difference in the lamp load, and is, in consequence, attended by an increase of speed in the dynamo and of brightness in the remaining lamps.

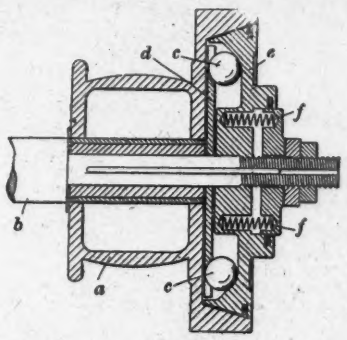


Fig. 7.

Constant speed devices usually consist of a governor-controlled clutch. An exceedingly good form is one constructed by Messrs. Joseph Lucas, Ltd. Fig. 7 shows a section of the clutch. A driving pulley *a* is arranged to run freely on the armature shaft *b* and is shaped at one end to contain a number of free governor balls *c*. The latter are supported in slots in a plate *d* keyed to the armature shaft, and are arranged to bear against the inner surface of a clutch element *e* which whilst secured to the shaft can slide thereon. The inner periphery of the pulley is shaped to correspond with the outer coned periphery of the part *e*, and between the two surfaces is inserted a thin ring of vulcanised fibre. Springs *f* serve to keep the clutch in action. At and below a certain speed the mechanism revolves as one piece, but above that speed the balls, by their centrifugal action, relieve the pressure due to the springs between the clutch surfaces and enable slipping to occur. There is no appreciable separation of the clutch surfaces when in action, but simply a variation of pressure. It will be observed that the balls are connected to the driven part and not the driving part of the mechanism.

As might be expected, a jerkiness of action is a common fault in slipping clutches at the critical speed owing to the difference between static and kinetic friction, and a drop in speed is often experienced at the instant when slipping begins; or, in other words, the clutch can continue to accelerate the speed of the

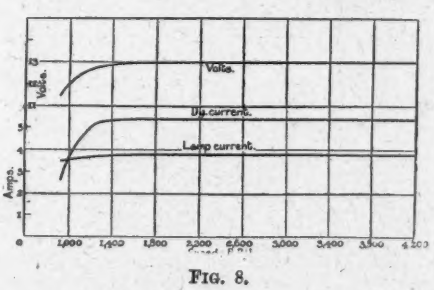


Fig. 8.

armature beyond the maximum speed for which the clutch is adjusted, but as soon as slipping sets in the speed drops and remains tolerably constant at all superior speeds of the driving pulley. Messrs. Lucas have avoided this defect by arranging for ample lubrication of the clutch surfaces so that they are always separated by a thin film of oil. By this provision the instant at which slipping occurs becomes practically imperceptible, and an extremely smooth action is obtained. Fig. 8 illustrates the results of a series of tests made on a Lucas dynamo fitted with a clutch of the type above described. It will be observed that the maximum ontput remained perfectly steady. With variation of load an increase of the maximum dynamo speed was obtained and a consequent increase of voltage. When supplying current (3·8 amperes) to two 12-volt head lights and three 4-volt side and tail lights the maximum voltage was 13. On cutting out the side and tail lights the voltage increased to 13·6, whilst on cutting out the head lights (leaving the others in service) the voltage rose to 14. The variation is not serious, but it serves to show that in some degree the governor-controlled clutch possesses the same characteristic as the constant-torque clutch. This difference must be observed however, namely, that by increasing the sensitiveness the speed variation under varying loads can be made much smaller in the governor-controlled clutch than in the constant-torque clutch. It is doubtful, however, whether anything is to be gained by developing the mechanism beyond a certain point, seeing that, even with a perfect mechanism, it is practically impossible completely to avoid variations of voltage with variations of load owing to conditions existing in the dynamo and battery. Such results as those obtained in the tests referred to are sufficiently good for practical purposes. As with other machines, the Lucas dynamo is arranged to work in conjunction with a battery, supplying into the latter about 2 amperes when the maximum output is reached. When the clutch is adjusted to suit the particular lamps and battery which it is required to supply, the cutting out of the battery involves a large (though restricted) increase of voltage in the lamp circuits This is, however, not so serious as in the electrically regulated systems described, and would not render it impossible to use the lights in the event of a mishap to the battery. Much if not all the variation experienced in the working of the lighting systems above described, and not due to speed variation, is due to the battery.

Discussion.

Mr. L. Murphy said that many of the devices discussed simply provided means for waste of the surplus energy when the engine was running at speeds just higher than necessary for the generation of the voltage required by the lamps. In one case this surplus energy was thrown in the battery, and in the other a clutch wasted energy in the form of heat. He did not care for the term "constant torque" and "constant speed" as applied by the author to the clutches; it would be more correct to call them "torque limiting" and "speed limiting" clutches. With a true constant speed device one would simply have an ordinary shunt-wound or magneto dynamo, and leave the constant speed device to do the rest. He took strong exception to the author's condemnation of the magneto machine; it was not necessary to design these machines in such a way that they demagnetised themselves at all in use. A strong point in favour of the magneto generator was its comparatively high efficiency for machines of small output.

Dr. S. P. Smith said that the trouble seemed to arise in the attempt to drive the lighting dynamo from the main engines, the speed of which could not be constant. Surely some attempts must have been made to avoid these complicated contrivances by installing a small auxiliary set for lighting quite independent of the main engines. The advantages of such an arrangement were obvious. The space taken up would be very small owing to the small output required, and since the battery would now be superfluous, the auxiliary engine might be accommodated in the space thus made free.

Mr. R. V. C. Brook, referring to the Bleriot system, said the constant action of the dynamo pumping surplus current into the battery was very detrimental to the latter, and in a case which had come under his notice the battery was found to be useless after a short time. He agreed that it should be possible to produce a magneto machine suitable for car lighting which would be more efficient than the self-excited type, and should have a fairtly long life, judging from the performance of the modern ignition magneto. The slipping clutch seemed to him to be unmechanical, and unless it was looked after, would give trouble owing to the rapid wear.

Mr. R. G. Porte did not agree that the battery system was unsuitable, inasmuch as the dynamo had not been sufficiently tested on the heavier type of vehicle. Five years ago he tried a dynamo, and found that owing to the excessive vibration to which it was subjected, the result was not satisfactory. He, therefore, adopted the battery, and installed it in 100 of the London type 'buses, which in a period of five years travelled over 10 million miles. At present there were 150 'buses running in London with that system installed. The batteries were properly looked after, one set being charged while the other set was in use. They were of Tudor make, and were admiraly suited to the work. The cost of the battery system was about quarter of the dynamo system.

Mr. M. A. E. L. Moharram did not think constant candle-power necessary, and considered that the varying speed of the car might be taken advantage of to supply illumination which varied as the speed.

Mr. E. Williamson noticed that Mr. Morgan omitted all reference to the permanent-magnet machine without any regulating field winding, and said he would like to hear his views on the capabilities of such machines.

Mr. J. D. Morgan, in reply, said that a properly designed electrically-regulated machine did not spoil a battery, and a properly designed slipping clutch was not subject to serious heating. Regarding permanent-magnet machines, it was very hard to obtain any reliable information, and he had not succeeded in obtaining any machine for testing purposes. It appeared to be generally accepted that magnetos were subject to rapid weakening of the field, and consequently a machine which when new was constructed to give a certain output at a certain speed would be found to be unable to maintain the output after a short period of use on the road. It was admitted, however, that magnetos provided a very attractive alternative, and if it was found that they were not subject to deterioration they would be very useful for car lighting. The use of a small auxiliary set driven from an independent engine had already been considered by more than one well-known engineer, and eventually that system might be adopted. A little experience of motoring at night was sufficient to convince anyone that uniform brightness of the lamps was essential. The author had tried a machine excited from a battery and having an extra large accumulator arranged in parallel with the lighting circuit; it was found that some degree of regulation could be obtained in this way, but it was not sufficiently good for practical purposes.

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

2,253. "Registration and automatic time recording of trunk telephone calls." S. D. Williams. January 29th.

2,271. "Telephone switchboard connecting cords." P. P. Craven. January 29th.

2,284. "Electric incandescent lamps." Deutsche Gasglühlicht Akt.-Ges. (Auer. Ges.) (Convention date, November 4th, 1911, Germany.) January 29th. (Complete.)

2,310. "Automatic battery over-discharge preventer." H. Leitner. January 29th.

2,319. "Means and apparatus for storing and transporting incandescent electric lamps." E. H. Archer. January 29th. (Complete.)

2,320. "Automatic and semi-automatic telephone circuits." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) January 29th. (Complete.)

2,325. "Electric railways having automatic traction systems." J. J. Deschamps. (Convention date, January 30th, 1911, France.) January 29th. (Complete.)

2,336. "Sanitary protectors for telephone transmitters." C. Adams. January 29th. (Complete.)

2,343. "Methods of and machines for electric welding." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats-Ges., Germany.) January 29th.

2,348. "Drying articles moulded from clay or other wet material more especially intended for use in connection with the drying of multiple channel conduits for electrical conductors." R. Lawton. January 29th.

2,355. "Contact apparatus for electric indicators for indicating the direction of rotation of a shaft." P. Molinari. January 29th. (Complete.)

2,389. "Receiving apparatus for electric oscillation." Ges. für Drahtlose Telegraphie G.m.b.H. (Convention date, March 14th, 1911, Germany.) January 30th. (Complete.)

2,413. "Magnetic blow-outs for electric switches or the like." Siemens-Schuckertwerke G.m.b.H. (Convention date, January 31st, 1911, Germany.) January 30th. (Complete.)

2,423. "Process for the production of non-porous electro-deposited coatings upon metal sheets." B. Lowy and F. Muller. January 30th. (Complete.)

2,442. "Electrostatic machines for the production of alternating current." W. Petersen. January 30th. (Complete.)

2,456. "Aerial conductors used in wireless telegraphy." Marconi's Wireless Telegraph Co., Ltd., and C. E. Prince. January 30th.

2,457. "Wireless telegraph receiving apparatus." Marconi's Wireless Telegraph Co., Ltd., and C. E. Prince. January 30th.

2,467. "Sparking plug for internal-combustion engines." C. H. Stevens. January 30th.

2,468. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) January 30th.

2,471. "Vapour alternating-current rectifiers and similar apparatus." Hartmann & Braun Akt.-Ges. (Convention date, February 3rd, 1911, Germany.) January 30th. (Complete.)

2,472. "Interrupters for magneto-ignition apparatus." H. Diehl. (Convention date, February 3rd, 1911, Germany.) January 30th. (Complete.)

2,480. "Sparking plug for a petrol combustion engine." H. J. Farrell. January 30th.

2,497. "Insulated coupling for all classes of electric cables." H. Cowey. January 31st.

2,505. "Conductors and supports for use in incandescent electric lamps and the like." A. C. Hyde. January 31st.

2,517. "Electric alarm device for measuring instruments." S. Worliczka and M. Sluzar. January 31st.

2,522. "Electrical water heaters." M. H. Shoenberg. (Convention date, April 29th, 1911, U.S.) January 31st. (Complete.)

2,563. "Production of electrolier and analogous sheet-metal chains." H. B. Butler. January 31st.

2,566. "Illuminated signs adapted to be supported above the globe or like part of an electric or gas lamp." W. H. Beville. (Addition to 229/1912.) January 31st.

2,573. "Pocket lamps." J. J. Mullaney. (Convention date, February 9th, 1911, U.S.) January 31st. (Complete.)

2,575. "Construction of electrical accumulator." P. Marino. January 31st. (Complete.)

2,594. "Electrodes for accumulators with alkaline electrolyte." W. K. L. Dickson. February 1st.

2,598. "Dynamo-electric machinery." R. A. Holbech. February 1st. (Complete.)

2,630. "Means for and methods of charging and discharging electric accumulators or secondary batteries." A. M. Taylor. February 1st.

2,649. "Device for securing electric conductors and the like to walls or other supports." W. T. Henley's Telegraph Works Co., Ltd., and A. J. Hedgecock. February 1st.

2,671. "Automatic and semi-automatic telephone circuits." Siemens Bros & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) February 1st. (Complete.)

2,672. "Automatic and semi-automatic telephone circuits." Siemens Bros. & Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) (Addition to 2,320/1912.) February 1st. (Complete.)

2,688. "Electrical storage batteries." R. J. Crowley and L. Turner. February 2nd.

2,701. "Electrical condensers." British Insulated and Helsby Cables, Ltd., and E. A. Bayles. February 2nd.

2,702. "Electromagnets." D. E. Barnes and A. A. G. Jensen. February 2nd. (Complete.)

2,711. "Couplings for electric wires." W. Johnson. February 2nd.

2,734. "Self-excited direct-current dynamo-electric machinery." Akt.-Ges. Brown, Boveri & Cie. (Convention date, February 24th, 1911, Germany.) February 2nd. (Complete.)

2,738. "Electric clock systems." A. R Upward. February 2nd.

2,743. "Automatic and semi-automatic telephone circuits." Siemens Bros. and Co., Ltd. (Siemens & Halske Akt.-Ges., Germany.) Addition to 2,320/1912.) February 2nd. (Complete.)

2,747. "Switches for opening and closing electric circuits." H. Leitner. February 2nd.

2,757. "Sparking plugs for internal combustion engines." A. J. H. Burnett. February 2nd.

2,760. "Electrodes for use in electric welding." A. P. Strohmenger. February 2nd.

2,764. "Electrical heating and radiating apparatus." H. S. Martin. February 2nd.

2,768. "Sparking gaps for use in electric circuits adapted for rapid electric oscillations." W. P. Thompson. (Ges. fur Drahtlose Telegraphie m.b.H., Germany.) February 2nd.

2,769. "Wireless telegraphy installations." W. P. Thompson. (Ges. für Drahtlose Telegraphie m.b.H., Germany.) February 2nd. (Complete.)

2,770. "Masts for use in wireless telegraphy installations." W. P. Thompson. (Ges. für Drahtlose Telegraphie m.b.H. Germany.) February 2nd. (Complete.)

2,817. "Electric power transmission apparatus." Macfarlane Engineering Co., Ltd., and W. A. Macfarlane. February 3rd.

2,823. "Integrating electricity meter." R. Kennedy and D. R. Kennedy. February 3rd.

2,872. "Electrical device for catching and destroying flies and other small insects." A. J. Wright and W. W. Niblok. February 3rd.

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1910.

Printing Telegraphs. B. Soldatencow. 14,659. June 17th. (January 17th 1911.)

1911.

Arc-Light Projector for Stage Lighting and other purposes. Thompson. (Scwabe & Co.) 18,290. August 11th.

Methods of Mounting Overhead Wires for Electric Railways and the like. Siemens-Schuckertwerke Ges. 20,031. September 8th. (September 8th, 1910.)

Telephonic Apparatus. E. A. Graham. 20,898. September 21st.

Construction of Jack-Strips for Telephone Switchboards or the like. Siemens Bros. & Co. and E. A. Petithory. 22,897. October 11th.

Electro Comb. G. Meyer. 23,183. October 20th.

Cooling Devices for Röntgen Tubes. Firm of C. H. F. Muller. 23,325. December 23rd. (December 15th, 1910.)

Electrical Water-Heaters. L. Katz. 23,830. October 27th.

Regulating Device for Polyphase-Current Arc Lamps. A. Heimann and W. Schaffer. 25,586. November 16th. (November 17th, 1910.)

Electric Wiring of Buildings. L. Milne. 348. January 5th. (Cognate application, No. 13,213 of 1911.)

Bayonet Cap and Socket Connections of Incandescent Electric Lamps. C. G. M. Bennett. 585. January 9th.

Application of Electricity to Surgical, Optical and like Instruments. S. Richardson. 643. January 10th.

Electric Metallurgical Furnaces. V. Stobie. 674. January 10th.

Electrical Apparatus adapted for use in Mines and the like. Sandycroft Foundry Co. and T. M. Dutton. 680. January 10th.

Apparatus for Cooking or for carrying out like operations by means of Electricity. G. C. Bell. 634. January 15th.

Means of Control for Petrol-Electric Vehicles. M. Stevens. 988. January 13th.

Drawn Wires suitable as Illuminating Bodies for Electric Incandescent Lamps, and Process for Manufacturing same. Deutsche Gasglühlicht Akt.-Ges. (Auerges.) 1,161. January 16th. (August 13th, 1910.)

Electric Controllers or Switches. F. Jackson and G. E. Pearson. 1,658. January 23rd.

Searchlights or Projectors. Siemens. Bros. & Co. and R. Bradley. 3,922. February 9th.

Combined Magneto-Ignition Gear for Internal-Combustion Engines and Wireless Telegraphy Apparatus, particularly applicable to Aerial Vessels. M. F. Sueter, F. L. M. Boothby and H. G. Paterson. 3,534. February 9th.

Electric Light Standards. E. G. Byng and J. H. Collings. 5,418. March 4th.

Sparking-Plugs for Electrical Ignition Purposes. L. R. Jones. 5,790. March 8th.

Switches and Interrupters for Electric Circuits. N. Schultz. 7,097. March 24th.

Electric Motor Starting Switches. J. Johnson. 8,515. April 3rd.

Electrical Indicators for Railway Signal Lamps. W. H. I. Welch. 8,981 April 11th.

High-Frequency Transformer, especially suitable for use in Wireless Telegraphy and Telephony. R. Goldschmidt. 11,162. May 9th. (May 9th, 1910.)

Alloys for use in Making Dynamos. W. Rubel. 12,483. May 23rd. (Convention date not granted.)

Telephonic Exchange Switchboards and Arrangements. S. Graham. 13,887. June 5th.

Pocket Lamps. R. Schwager. 15,818. July 8th. (July 8th, 1910.)

Telephonic Exchange Systems. Western Electric Co. (Western Electric Co.) 16,075. July 11th.

Electrical Driving Devices for Sound-Reproducing Machines. M. Kaiser. 16,456. July 18th.

Time-Switches or the like. A. G. Zenner. 17,718. August 3rd.

Manufacture of Incandescent Electric Lamps and Apparatus therefor. K. Schwab. 20,380. September 14th. (January 11th, 1911.)

Plug and Socket Connections used on Electric Lighting or Power Circuits. A. P. Lundberg, G. C. Lundberg and P. A. Lundberg. 21,678. October 2nd.

Plug and Socket Connections for Electrical Apparatus. Naamlooze Vennootschap Fabriek van Instrumenten en Electrische Apparaten "Inventa." 23,622. October 25th. (November 4th, 1910.)

Three-Contact Plugs for Telephone Switchboards or the like. Siemens Bros. & Co. and W. H. Grinsted. 23,910. October 28th.

Electromagnets. A. Quastenberg. 24,146. October 31st. (November 14th, 1910.)

Electrical Imports and Exports in January.—The foreign trade figures show that in the month of January there were advances of £4,309,000 in imports, of £2,685,000 in exports, and of £953,000 in re-exports. The following are some of the figures of particular interest to our readers:—

Exports.

Electrical goods and apparatus...	£275,091 ... Inc.	£72,095
Machinery...	£2,666,642 ... Inc.	£180,559

Imports.

Electrical goods and apparatus...	£139,961 ... Inc.	£14,191
Machinery...	£514,947 ... Inc.	£81,228